Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LII. NEW YORK, SATURDAY, OCTOBER 31, 1908. No. 18.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. MCGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
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239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....4.50
Other Foreign Countries within the Postal Union.....6.00
25 shillings 25 marks 31 francs
Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of ELECTRICAL WORLD *for 1908 to date has been 762,500 copies. Of this issue 15,000 copies are printed.*

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MEASURING THE SLIP AND SPEED OF INDUCTION MOTORS.

It is generally recognized that speed indicators, unless very elaborate and expensive, are prone to a practically considerable error, so that in observing the speed of rotation of dynamo machinery, the ordinary speed indicator is not reliable for many purposes. The speed-counter and stop-watch is also an unsatisfactory combination which is sometimes unreliable. Stroboscopic methods for measuring speeds are certainly susceptible of a high degree of precision, and are also capable of practical simplification. In determining, for example, the slip of an induction motor, a stroboscopic method, although by no means the only reliable method, is a very convenient, reliable method. One well-known variety of this method is to mount a disk with painted sectors on the induction-motor shaft and illumine it by an alternating-current arc lamp supplied from the same mains as the motor. At synchronism, the disk appears stationary in space. As the slip increases, the speed of the disk's rotation increases, and its apparent speed can readily be observed with the aid of a stop-watch. Another variety of this method is described by Prof. Charles A. Perkins in the article we publish this week on page 944. One or more radial slots are cut in the disk on the motor shaft, and an electromagnetically vibrating strip, in synchronism with the circuit, is observed through the slots. The article also describes a modification of this method for determining absolute rotary speeds, as distinguished from relative speeds or slips. An electromagnetic tuning fork performing free vibrations is watched through the slits in a motor-mounted rotating disk. This method bears relation to one described by Messrs. Kennelly and Whiting at the convention in Atlantic City of the American Institute of Electrical Engineers last June.

THE VOLTAGE RATIO OF TRANSFORMERS.

Our correspondence column this week contains a communication from Mr. M. G. Lloyd on the subject of what should be the proper definition of the "voltage ratio" or "transformation ratio" of a transformer, a question of very general interest. A transformer with its primary coil connected to a 2200-volt circuit and its secondary coil connected to a 220-volt circuit is, as all will agree, a step-down transformer. Should its voltage ratio be called 10 or 1/10? This is a matter of convention, and not a question of physical necessity. Mr. Lloyd used the former definition in his article of Oct. 17, page 845; but we do not suppose that he is wedded to that definition beyond conversion. He justifies his selection of a ratio of 10 for such a step-down transformer by reference to manufacturers' nameplates. In text-books, as he pointed out previously, reference can be found on both sides of the question. It is true, as indicated by Mr. Lloyd, that the standardization rules of the American Institute of Electrical Engineers do not explicity define this term, but implicitly they do define it unquestionably as the ratio of secondary terminal volts to primary terminal volts, or as 1/10 in the above example. Reference is here made to Section 307 on page 1099 of the Rules for 1907. This section states that the

2200-volt pressure with *the step-down transformer ratios 1/10 and 1/20, in general use*, is recommended. Moreover, throughout the rules, as in "efficiency," "power factor," "pulsation," "variation" and "reactive-factor," all of which are simple numerical ratios, the secondary or required quantity is obtained by multiplying the primary quantity by the ratio and not by dividing. Consistently with this convention, the voltage ratio of a step-down transformer should be 1/10 as given in Section 307, and not 10. Step-up transformers should have ratios greater than unity, as expressed, although not so definitely as might be desired, in Section 309. Of course, we may have to face inconsistency as the result of industrial habit, as when we call the "watts-per-candle" of an incandescent lamp the "efficiency," whereas we mean a quantity of the nature of an "inefficiency," or the reciprocal of an efficiency. But if we can, we ought to avoiding riveting such inconsistency on industry. It must be admitted that the choice of the definition of voltage-ratio involves in itself no necessary contradiction in terms, although the above ordinary use of lamp "efficiency" involves a contradiction in terms, in and of itself.

Electrical Inspection.

The convention of the Western Association of Electrical Inspectors, held last week in Chicago, brought up a number of matters in relation to electrical inspection which are of direct interest to all connected with the electric light and power industry. The full report of the meeting, owing to lack of space, is held over until next week, but elsewhere we print the address before the convention by Mr. W. H. Blood, Jr., on "Electrical Inspection from the Viewpoint of the Central Station." In the discussion of this address an instance was brought up where the extensive condemnation of wiring in the down-town portion of a small town resulted in the throwing out of electric light and the installation of a gasoline lighting system in almost every store. No details were given of the case, which probably has been duplicated in other places; but it is safe to assume that the management of the central-station company and the service given must have been very poor for such a thing to happen. If the company had looked after the condition of customers' lamps and considered the possibility of using high-efficiency lamps for dissatisfied customers, the probabilities are that the whole business district of the town would not have gone over to gasoline. When wiring was condemned, it would then have been in much better condition to persuade merchants to spend a little money improving their circuits, and rather than let gasoline get such a hold it would have been justified in offering to take a part of the expense of rewiring. This discussion also brought out another present glaring inconsistency in insurance rates as actually applied in practice. It is entirely too common to allow gasoline lighting plants to be installed without any advance in the rate, whereas, as President Townsend put it at the inspectors' convention, 500 small defects in electric wiring would not create a fire hazard as great as the installation of one unapproved gasoline lighting system. The importance of greater familiarity with and adherence to the National Electrical Code was reiterated many times during the convention, and it would be well for all concerned in the electrical business if the boiled-down experience of many years, as expressed in the Code, were more generally taken advantage of. However, considering the present unsatisfactory form of the Code, it is not altogether strange that even electrical inspectors are not familiar with all parts of it. The revision and rearrangement of the Code which is now going on will be a great help to the better understanding of its provisions.

Engine Load Factors.

It is frequently the case that insufficient attention is given both in planning and operating central stations to the question of keeping the engines in operation as fully loaded as possible. Although it is well known by engineers that much better economy is obtained when an engine is run nearly loaded than when it is very much underloaded, this point is frequently forgotten when new machinery is installed or a new plant is being built, because of a desire to purchase large units. It is, of course, true that small units cost more per kilowatt of capacity, and that larger units are more economical when working under full load than small units. The point lost sight of is that frequently a large unit must be run underloaded a large part of the time. We have in mind one station which was probably the most antiquated of a number owned by a large syndicate. It had a miscellaneous assortment of various sizes of belted units. Nevertheless this station under good management was able to make the best showing in coal consumption per kilowatt-hour of any of the stations. This was largely because of the fact that the operating engineers watched every point closely, and operated engines of a size adapted to the load as nearly as possible. As there were so many sizes, it was not necessary to operate engines underloaded to any extent. In any central station which operates 24 hours per day, it is a matter of prime importance not to be obliged to run a very large unit underloaded many hours. For this reason, it is well to plan so that there will be one fairly economical unit which can carry the daylight load. Of course, in a growing plant conditions are constantly changing, so that a unit which would carry the daylight load one year would be insufficient in two or three years. It is also true that as a central station grows constantly, units which are rather large for the size of the plant to-day may be about right five years hence. Therefore, the size of units selected must usually be a compromise. If economy of operation and the provision of reserve units are considered, there is likely to be more danger of selecting too large units when the plant is extended than of getting them too small. As a general rule, the more numerous the units of a station, the less likelihood of interruption to service by the breaking down of one unit, because each unit is such a small fraction of the total. Nevertheless, for the sake of simplicity and low cost per kilowatt of capacity, there is always a temptation to select very large units.

The Incandescent Lamp Situation.

The gradual evolution of the tungsten and other metallic filament lamps from the experimental stage into steady commercial service has been most gratifying, and one is tempted to look forward a bit to see what the outcome will be. We decline to give our imagination free rein in this matter, prophecy after the fact being to our notion the only safe kind in electrical cases. Various reports have been floating about concerning alleged new incandescent lamps working down to half a watt per candle, and all that sort of thing. We have tried industriously to run such reports to earth and dig them out, but thus far there has been too little scent for even the most experienced sleuth to follow. The new lamp is like

malaria, always located in the next county, and attempts to get direct information generally lead to the disclosure that Prof. Doe told some one that his old friend Roe was engaged on a new filament that he had been able to work at half a watt per candle. The probable origin of the alleged high efficiency is that some lamp actually was burned over-voltage and was turned off before it burned out. As a matter of fact, a tungsten or tantalum lamp or even a carbon lamp will work for a few minutes at enormously high incandescence, and if one does not inquire too closely into conditions, a truly wonderful performance may be put on record. When one hears of, or even sees, remarkable experiments with new filaments, he had better consult some friend who knows what can be done with existing lamps before buying any of the stock that usually can be found if one wants it.

As to the tungsten lamp, it is certainly meeting with very gratifying success, and the recent reductions in price have done much, and will do more, to encourage its use. The early blackening that was occasionally reported seems to have been overcome, and the average useful life seems to be fully up to the claims made for it. The fragility of the filament is the chief trouble and there is evidence of material improvement in this particular. The lamps can now be shipped without much trouble and can be distributed with very small breakage. It is when they get into the hands of the user that mischief starts. It is curious how much one of these fragile filaments will at times endure, and even more curious to note on what slight provocation it may fail. A jar overhead, a key socket snapped too hard, a slight tap on the shade, may break the filament, although it may have stood successfully much rougher treatment. Yet, on the whole, including all chances for breakage, the life of the lamps is remarkably good. The coming of the 25-watt lamp, in itself of great importance from the standpoint of economy, is very likely to lead to more temporary difficulty from breaks. The filament of such little lamps is extremely slender, and while of reasonably long life in hours of burning, can hardly be expected to stand shocks as well as the thicker filaments. We note a tendency to talk about low-voltage lamps, on individual transformers, as a refuge from fragility. Such lamps are both efficient and relatively strong, but there is some loss and expense connected with the little transformer, and there are, from the standpoint of the central station, some difficulties to be overcome. Does anyone know, for example, what quadrature current would be likely to be imposed on a system by the connection of a thousand such transformers? Of course, with tertiary transformers the current flow stops when the lamp goes out, yet high power-factor is not likely to be the strong point of a 25-watt transformer. Improvement in high-voltage filaments looks like a better solution of the difficulty.

The Fatigue of Insulation.

In the inorganic world we notice at least two salient phenomena which at first sight seem exclusively inherent to the lives of plants and animals, namely, memory and fatigue. We find, however, that these properties also pertain to inorganic materials, although in a more limited sense. In fact, it seems likely that memory and fatigue are presented by living beings because those properties are inherent in non-living matter. An interesting article by Prof. A. S. Langsdorf, on page 942 of this number, draws attention to the fatigue of insulators, which fatigue has important practical significance. Every central-station manager necessarily comes into contact with the subject of insulation fatigue, in the sense that the insulating materials employed in his transmission and distribution conductors must not be overfatigued if they are to remain in active service. Our knowledge of insulation fatigue is still primitive; but researches, such as those contained in the article here considered, tend to place it on a scientific basis. Judging with the aid of mechanical analogies, we may start by assuming that in an insulator we have a mass of molecules in which there are either very few free ions; that is, the ions are nearly all bound up tightly into rigid molecular bundles; or, that the structure of the material imposes great difficulty on the transition of the free ions. Under either supposition, we know that when an electric stress is brought to bear upon the material, very few ions move therein so as to carry electricity from one electrode to the other; whereas, in an electrolyte or, still more, in a metal, the same electric stress would produce a rapid movement of electric charges by ionic displacement. When, however, we exceed a certain critical intensity of stress, depending upon the chemical and physical organization of the material, the ionic rigidity is destroyed, and the insulation breaks down with the passage of a current. If we apply an electric intensity approaching the critical value, we may expect to find a difference in the effect produced, according as we apply the stress slowly and uniformly, or suddenly and swiftly. We may expect to find a material yield to a suddenly applied stress, which it would not yield to the same stress applied gradually.

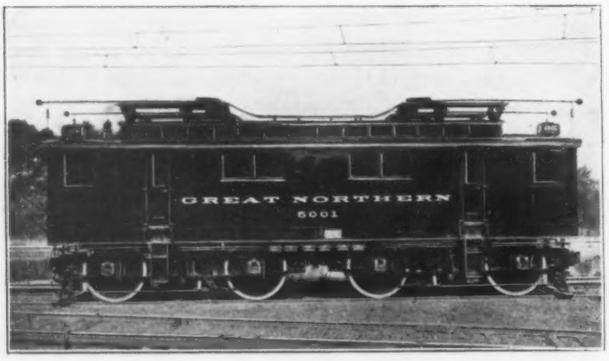
In an alternating stress, we have the stress constantly changing with a mean rate that is in proportion to the frequency of alternation. We may, therefore, reasonably expect a material to break electrically under a certain maximum value of alternating stress when it did not do so under the same maximum value of continuous stress. Moreover, a jagged alternating e.m.f. wave might be more disruptive than a smooth, sinusoidal e.m.f. wave of the same maximum value. Experimental determinations on this question are still insufficient to warrant a positive statement. Again, following the mechanical analogy, as pointed out in the article, a material subjected to a continual alternating stress near the critical value may be expected to break down in time, or under fatigue, when it might be able to sustain the stress for a short period. In other words, the insulation fatigue is to be looked for even with continuous stress, and particularly with alternating stress. This is a well known fact in electrical engineering. The duration of a high-voltage test has great influence upon the amount of the voltage that can be withstood. But this is not all. If the fatigue occurred under constant physical conditions, the curves of breakdown voltage against time, as given in the article, might be hoped to follow some fairly simple law. But under the application of the stress, hysteretic waste of energy occurs in the material with increase of temperature; so that during the progress of the test the observations advance from the curve belonging to the initial temperature to the curve belonging to the highest temperature reached, and this tends to obscure the real action of time when freed from temperature variation. The curves obtained involve two variables, time and temperature, of which only the time element is portrayed. In the practical application of these considerations, we must aim to keep our alternating stresses well below the elastic limit, and to keep down the temperature. If we can succeed in doing these two things, the fatigue of the insulation will not play a prominent part.

Three-Phase Locomotive for the Great Northern Railroad.

One of the four locomotives which the General Electric Company will supply to the Great Northern Railroad for hauling trains through the Cataract Tunnel has been completed and is now being subjected to exhaustive tests under service conditions. Although a liberal air-gap of ¼ in. has been allowed, the power factor remains above 80 per cent throughout the whole operating range and reaches a maximum of 86 per cent. The maximum torque is at least three times the guaranteed full-load running torque and is more than sufficient to spin the wheels under any condition of track. It is noteworthy, moreover, that the motors, being of the three-phase induction type with plain secondary rheostatic control, are capable of exerting this torque at any speed from standstill to within a few per cent of synchronism.

A view of the completed locomotive is given in the accompanying illustration. The locomotive is of the double-truck type, and there are two motors per truck. The total weight is 230,000 lb., all of which is on the drivers. The over-all length is 45 ft. and the rigid wheel-base is 11 ft. The wheels are 60 in. in diameter.

As stated above, the motors are of the three-phase induction type. The secondary circuit of each motor is mounted on a shaft geared at both ends to one axle of the locomotive. The



THREE-PHASE LOCOMOTIVE.

gear ratio is 1-to-4.28. The motors are wound for eight poles and when operated at 25 cycles have a synchronous speed of 375 r.p.m. The motors are equipped with slip-rings for plain rheostatic control. In order to obtain the maximum of simplicity no effort has been made to operate the motors in cascade or to use any pole-changing device. It was held that the saving in energy by the introduction of speed-changing schemes was of no importance, because the energy is obtained from a hydro-electric station where there is no storage available, and any saving at the motors will represent merely a saving in water which would then be allowed to flow over the dam.

In arranging the apparatus and controlling devices within the locomotive the keynote has been simplicity. Step-down transformers, contactors, blowers, air compressors, etc., are placed within a fireproof compartment located in the center of the body of the locomotive, a wide alley-way being arranged on all four sides of this compartment. The transformers for changing the line pressure of 6600 volts to 500 volts for use at the motors are of the air-cooled, two-coil type. A negligible saving in constructive material could have been obtained by using auto-transformers for this purpose, but the improved insulation and the reduction in the risk-to-life by the use of two-coil transformers were considered of predominating importance. The air which is forced through the transformers passes upward through ventilating openings in the top of the locomotive after having passed through the speed-controlling rheostats. The motors also are cooled by air, all of the low-pressure supply of air being obtained from a centrifugal blower driven by a three-phase induction motor.

As will be noted from the illustration, the locomotive is equipped with four-wheeled trolleys, two of which will be used for operation in each direction, the rail being employed as the third conductor. The normal trolley potential will be 6000 volts, but it will reach a value of 6600 volts during starting conditions on account of the fact that Tirrill regulators will be employed at the station for increasing the e.m.f. with increase in load. It is expected that the speed regulation of the driving turbines will not be close, but this condition is looked upon as advantageous rather than disadvantageous. For example, under starting conditions when the load is heaviest the speed will be lowest. The reduction in speed does not involve a decrease in e.m.f., but merely a lowering of the frequency. This change in the frequency will assist the locomotive in starting a train and will cause a shift of the load from other locomotives which may be running at full speed to the locomotive which is accelerating.

One of the advantages of a three-phase locomotive which was considered of much importance in the Great Northern equipment is the tendency to operate at constant speed. The gearing is such as to give to the locomotive a speed of about 15 miles per hour, which will be maintained on the up-grade and will be only slightly exceeded on the down-grade. When the train is going down-grade a certain amount of energy will be returned to the supply system. No importance was placed upon the return of this energy, but the limiting of the maximum speed was considered as of great importance. The tendency to limit the speed will not be affected by the removal of one trolley wheel from contact with the overhead wire.

According to the present plans, the locomotives will be used only through the Cataract Tunnel, which is somewhat less than three miles in length and has a uniform grade in one direction of about 1.7 per cent. However, in event of the satisfactory operation of the locomotive, it is probable that at least the two grades in the immediate neighborhood of the Cascade Tunnel will be operated electrically in the near future. The consulting engineer for the Great Northern Railroad Company is Dr. Cary T. Hutchinson, under whose supervision the entire installation is being made.

Commonwealth Edison-City Railway Power Contract, Chicago.

The terms of a contract for the supply of electric power to the Chicago City Railway by the Commonwealth Edison Company have just been officially made public in Chicago, although announcement of the fact that such a contract had been made was given in our columns in June.

The power is to be supplied by the power company to the railway company in the form of three-phase, 25-cycle, 9000-volt current. The railway company is to pay a minimum, primary, readiness-to-serve charge of $1.25 per kilowatt of demand per month. The kilowatts demanded are to be taken as 21,000 as a minimum for the first year of the contract, and as much more as may be demanded. For the remaining nine years of the contract the railway company shall pay according to the following provisions for determining the maximum demand:

The railway company's maximum demand in kilowatts for each month upon which the primary charge is made shall be determined by taking three consecutive days in the month out of which there shall be selected two hours, of which one shall be the hour of greatest output in kw-hours in the first half of the day, and the other the hour of greatest output in the second half of the day. The combined outputs for the six hours selected in the manner thus indicated shall be greater than the combined output of six hours similarly selected from any other three consecutive days in the month. One-sixth of the aggregate number of kw-hours consumed by the railway company during the six hours selected shall be considered as the number of kilowatts constituting the railway's maximum demand. If the railway's maximum demand exceeds 21,000 kw during the first year, the railway is to pay $1.25 per kilowatt of demand for each month for all in excess of 21,000 kw.

In addition to the primary or readiness-to-serve charge the railway company is to pay 0.415 cent per kw-hour for all energy used up to Jan. 31, 1910, and 0.4 cent per kw-hour for the remainder of the contract.

The power company is always to stand ready to supply a maximum demand equal to the highest previous maximum demand established for any preceding month, and also such additional demands as may be required under one or more of the following provisions: The railway company may make a written demand for an increase of supply to go into effect after May 31, 1909. The power company must be given five months' notice if the increase demanded is to be not more than 4000 kw, and 10 months' notice if the increase demanded is to be more than 4000 kw. At least five months shall elapse before the railway company can have the right to make another demand for an increase to go into effect within 10 months. The Board of Supervising Engineers of Chicago Traction must approve all demands for an increase made under this contract.

The minimum amount which the power company shall be obliged to stand ready to supply, and upon which primary charges shall be made, shall not be less than 30,000 kw for the nine years ending May 31, 1918. The power company is to stand ready to supply a temporary excess of 10 per cent of that provided for under the foregoing provisions, but the railway company shall not rely upon such excess energy to supply large numbers of new cars or the acquisition of additional lines. Whenever an increase shall be desired for such reason it must be provided for by written demand. Demands for increase during the last three years of the contract shall have the effect of extending the contract for three years after the last of any such increases shall have gone into effect.

Underground transmission lines shall be used, and these shall be installed and maintained at the expense of the power company. The railway company is to maintain and operate the substations. The power company may occupy substations jointly with the railway company under mutual agreement. The 9000-volt transmission lines shall consist of three copper conductors, each of 250,000 circ. mil area. The power company guarantees that the average loss of energy transmitted in any one year from its power stations to the railway substations shall not exceed 5 per cent of the total, under conditions of unity power factor. The maximum demand in kilowatts and the kw-hour consumption are to be determined by meter at the power station. The meters are to be read at noon the last day of each calendar month to determine the kw-hours used during the month.

All meters shall be tested and calibrated every month in the presence of duly appointed representatives of both parties, and either party can make a written request for a test of meters. Any meter found to be not more than 2 per cent from normal shall be considered correct as to the registration of the number of kw-hours used in the past. If the error is in excess of 2 per cent, the readings for the previous month may be corrected in accordance with the error found. The power company is not to be held responsible or liable for any damages on account of the non-delivery of electrical energy by causes beyond its control. One clause of the contract provides for arbitration in case there is a difference of opinion as to the obligations of the contract.

The railway company is not to sell the power it purchases to other consumers, except certain railways named in the contract. The railway will not generate electrical energy or take energy from any other source for operating its system, after the first year of the contract, except that after June 1, 1915, the railway company may generate in its own plant any quantity of energy which it may need over and above that which the power company may then be obliged to supply or stand ready to supply. If the railway company begins to generate any energy at its own plants after 1915, it agrees to use enough to maintain a 35-per cent load factor for any month. If the load factor falls below 35 per cent (that is, if the average load in kilowatts is less than 35 per cent of the maximum load for the month) the railway is to pay for a kilowatt-hour consumption corresponding to 35 per cent load factor.

Electrical Inspection from the Viewpoint of the Central Station.

Mr. W. H. Blood, Jr., insurance expert of the National Electric Light Association, addressed the convention of the Western Association of Electrical Inspectors at Chicago Oct. 21 on "Electrical Inspection from the Viewpoint of the Central Station." Mr. Blood said that he disapproved of the formation of this association when it was organized lest it should supplant the Underwriters' National Electrical Association, so we should have two courts of final appeal. Such a condition would have resulted in chaos, but he congratulated the association and its officers for foreseeing this and preventing it.

From the standpoint of the contractor, the consumer and the central station, an official inspection of electric wiring yields a certain satisfaction which cannot be accomplished in any other way. The contractor is relieved of his responsibility when he secures his certificate of approval, and so is enabled to get his pay. The consumer feels confident that when the wiring has been inspected his installation is safe. The central station feels assured that the wiring has been done properly and that there is not much likelihood of a fire occurring through faulty wiring. The fact, however, that a municipal or Underwriters' inspector has passed upon the wiring of a property apparently does not, in the eyes of the court, relieve the electric lighting company from blame if injury occurs to persons or property caused by current coming in over the wires from the central station. The central station has always to prove that it has taken every precaution known to science. For this reason there is little direct advantage coming to the electric lighting company on account of the inspection. The central station would not, however, have inspections done away with.

An inspector should not receive an appointment until he has had several years of practical experience in electric wiring. Then he should be required to pass a civil service examination, the questions being based upon the Code. The Underwriters' inspectors are to-day largely taken from this class, but he regretted to say that many of the municipal inspectors were not. Graft is not a common fault among electrical inspectors. Mr. Blood believed that any system of fees is wrong. Underwriters' charges vary from nothing in New England to $5 an installation in certain parts of Maryland. Municipal charges vary in the same manner. It does not seem right that the users of the safest illuminant should be taxed when users of candles, kerosene and open-flame gas are allowed to use these illuminants without inspection and subject to practically no restrictions.

The National Electrical Code is the standard book of rules. The rules are not all perfect. The collection, however, is the best that we have, and it should be the only standard. It is the result of years of experience boiled down and put into workable shape. Additions have been made from year to year until its arrangement has become clumsy and somewhat ambiguous, but the Code is now in process of being revised. The Underwriters believe in maintaining its integrity. He wished that he could say as much for municipal rules. There are many city electricians or municipal inspectors who think that to make themselves known and to stand in with the city officials it is necessary to rush in and make additional rules. Many, in fact, almost all of these rules, are either whimsical or are already contained in some other form in the Code. With the possible exception of rules which relate to the life hazard, he believes that all municipalities could adopt the electrical Code in toto without revision and without supplements. Mr. Blood criticised the efforts of some inspectors to get ordinances passed forcing electric-light wires underground when the company could not afford underground construction.

In the discussion following this address, Mr. Montgomery, of Detroit, cited a case in a small town where a large amount of interior wiring had been condemned by the Underwriters. The result was that instead of rewiring for electric light, most of the merchants put in gasoline lighting plants and very much reduced the electric-light company's income. Mr. Blood raised

a question as to whether it would not have been better to consult the electric lighting company first and see whether an arrangement could be made to remedy defects by having the company do some of the work. Mr. Montgomery said the company had been consulted, but did nothing. Mr. Blood also said that the gasoline lighting outfits introduced much greater fire hazard than the wiring which had been condemned. President E. R. Townsend expressed himself very forcibly to the effect that 500 small defects in electric wiring will not create a fire hazard equal to that created by one unapproved gasoline lighting installation.

Differential Gas Rates Condemned by Massachusetts Commission.

An important decision has been issued by the Massachusetts Gas and Electric Light Commission, commenting adversely against differential gas rates as enforced by the Chicopee Gas Light Company. The decision is of interest to central station men in view of the previous decision of the board last spring in connection with the rates of the Edison Electric Illuminating Company of Boston, in which the differential system was regarded with disfavor. In the Chicopee case the gross price to commercial customers is $1.70 per thousand feet, with discounts of from 30 cents to 70 cents per thousand feet on monthly bills, according to the consumption. The 30-cent discount applies to a consumption of under 1900 cu. ft. and the 70-cent discount to a consumption between 74,900 and 75,000 cu. ft. Under this schedule the maximum net price is $1.40. The average price received for the total amount sold during the year ending June 30, 1908, was $1.32.

The board points out that the operating expenses of the company are not unreasonably high under the circumstances of its service. It states that a serious criticism of the company's charges is the claim of its manifest unfairness to the average consumer due to the peculiar system of differentials in force. In almost any lighting company the possible economies and resulting advantages to the public are largely dependent upon the volume of the output, and the management is bound to avail itself of every reasonable opportunity to increase its business. The commission says that with this end in view a schedule of rates contrived for the purpose of selling gas to do work otherwise more economically done by other materials and effective to this end, may, under some conditions, and in some companies, furnish very strong grounds for a differential rate. It should be clear, however, that the rate named is not a losing one, and that it will increase the company's profits as well as its business volume. Differentials of this kind are quite different in character and afford, according to the board, no justification for that practice which seeks to charge a large consumer one price and a small consumer a higher price merely because of a difference in size. No adequate justification for a differential on such a basis was presented at the hearing. The board states that so far as the schedule stands without other reasons for its support, it appears to be contrary to that sound public policy by which the relations of a corporation of this character to the public are to be determined. The failure of a company to secure a reasonable return from its business cannot be urged against a reduction in price if such failure be due to unreasonably low rates to some particular class or classes of its customers. Differentials may often be corrected and gradually eliminated by reductions in the maximum net rate.

The company has not yet had time to fully establish itself and complete its development, and the profits have never permitted a dividend of more than 4.5 per cent. In all its lighting business it meets the competition of an electric light plant owned and operated by the city, which has to a large extent popularized that method of lighting. In view of the facilities of the Springfield and Holyoke gas plants, the cost of manufacture in those cities is less than in Chicopee, and a contract has recently been made by the Chicopee company with the Springfield organization to supply gas at the Chicopee works for distribution by the latter company. The board recommends that this saving be shared with the company's customers, placing the maximum rate to be charged after Nov. 1, 1908, at $1.35 per thousand feet.

Long Acre Litigation in New York City.

On October 24 the Long Acre Light & Power Company obtained from Justice Bischoff, in the Supreme Court, a writ of certiorari for a reviewal of the Public Service Commission's refusal to grant a permit to the company to issue $10,000,000 worth of preferred stock to pay a dividend of 7 per cent and $50,000,000 of 6 per cent 50-year gold bonds and to install an underground electric system throughout the city. John C. Sheehan, vice-president of the company, represented to the court that the Public Service Commission refused the original request and at a subsequent rehearing again denied the application for permission to issue stock and bonds. The petition for the writ set forth that there was no lawful reason for the refusal of the commission, and states that if the commission's position is sustained it would ruin the company.

Justice Bischoff directed the Public Service Commission to file a record of its proceedings and the testimony taken at both the hearing and rehearing of the Long Acre company's application, together with its decision and reasons for refusing to grant the permits to the company. The writ is returnable within 30 days. The decision of Commissioner Maltbie was noted in these columns when delivered recently.

Illinois Central to Equip Electrically at Chicago.

The stockholders of the Illinois Central Railroad held a meeting at Chicago last week at which a resolution was passed instructing the directors to proceed with the electrical equipment of that company's Chicago terminal. This railroad has a very large suburban traffic, its service during the rush hours being very similar to that on elevated and underground lines. There has recently been considerable agitation along the south side near the lake shore for the electrical equipment of this company's suburban service on account of the noise and soot from the locomotives. The company occupies with its right-of-way the lake front from Twelfth Street to Fiftieth Street. At a meeting of the directors of the company held the same day the demands of citizens and city officials for electrification of the road was recognized as a reasonable one by a formal resolution, and the intention was expressed of proceeding with the electrical equipment. This is a work which has been talked of for years. Before the Columbian Exposition in 1893 the matter was seriously considered, but the art was too new at that time.

Changes in the Electrical Inspection Service of New York City.

Commissioner John H. O'Brien, of the Department of Water Supply, Gas and Electricity, has placed Mr. Charles F. Lacombe, chief engineer of light and power, in charge of the electrical bureaus of that department in all the boroughs of Greater New York, and at Mr. Lacombe's request has assigned Mr. Hubert S. Wynkoop, electrical engineer in charge of the Brooklyn bureau, as assistant engineer. This action accomplishes a long-desired result, namely, the placing of the various bureaus of electrical inspection under one head in order to secure uniformity of routine and rulings throughout the entire city. Heretofore considerable confusion has been caused by the absence of a central authority to whom disputes, applications for approval of appliances and proposed changes in the rules might be referred.

The personal equation will also be largely eliminated as to approval of appliances, materials, etc., by the formation of an advisory board, consisting at present of Mr. Lacombe, Mr.

Wynkoop and Prof. George F. Sever, of Columbia University, consulting electrical engineer to the department. The department has an agreement with the university to the end that the latter makes such tests of appliances as may be required. All applications for approval which require tests will be referred to Prof. Sever in the first instance, who will submit a report to the advisory board. The board will then submit a recommendation in the matter to the commissioner, whose approval makes the decision final. Frequent bulletins will be forwarded to the borough offices of the bureau, so that the engineers and chief inspectors of each borough will be advised simultaneously of the action taken.

With a realization that the department and the insurance inspectors are working along different lines of interest toward a common end, an arrangement is being made to effect closer relations with the underwriters and the lighting companies than have existed heretofore. Considerable complaint has existed over the difficulty experienced by contractors and material or "supply" men—even by the department chief inspectors themselves—in securing general rulings on doubtful points of information in advance of changes in the rules or of approvals or disapprovals of appliances. It is hoped to overcome this criticism by using the electrical papers to announce contemplated changes in the rules, so that interested parties may have an opportunity to present their arguments; and also giving thus to the public from time to time substantially such information as will be issued to the borough officers of the bureau. Furthermore, except in the cases of grave danger, no changes will be put into effect "at once," and every effort will be made to avoid the unnecessary hardship to the electrical contractors that comes from too swift action.

The three officers of the bureau are all graduate engineers and experienced in the lines of work required of the Bureau of Electrical Inspection. They realize fully what is expected of them, but request the patient aid and co-operation of the electrical fraternity in Greater New York.

Appraisals of Electric Railways.

At the opening fall meeting of the New England Street Railway Club in Boston on Oct. 22, Prof. D. C. Jackson, of the Massachusetts Institute of Technology, delivered an address on the appraisal of electric railways. He emphasized the value of an appraisal once in five or ten years in determining the true value of a property for discussion with municipalities and commissions, and pointed out that the combined book values of consolidated or reorganized plants are often less than the true inventory value. The cost of duplicating the property new, or if it is known, the first cost, should be considered in relation to the dividend demands, but the present value of the property in respect to depreciation should be used in apportioning taxes. It is as important to set aside a depreciation reserve as to pay wages.

Prof. Jackson urged that the only right way to figure depreciation in a public service property is to figure the life of separate parts of the equipment. In problems of rate making the public will accept the appraisal of an unbiased engineer while it distrusts the book values of a property. An inventory filed previously to an appraisal by a public board may at times be very useful as a check, and will often be helpful in the preparation of briefs in regard to the cost of service in any part of a large system. A successful and complete inventory should have a complete organization planned in advance, exact forms for recording all kinds of apparatus, and definite rules which must be obeyed implicitly. It is well to see every piece of equipment which belongs to the system, and to make reasonably sure of counting in invisible apparatus located underground or under the water. Unit costs determined at the outset and multiplied into the aggregates of each kind of apparatus insure results. From 25 to 50 per cent should be added to the labor and material cost to cover engineering, supervision, contractors' profits, interest, insurance, cost of organizing, advertising, sale of securities, and working capital.

Boston Edison Equipment in a Nutshell.

The Edison Electric Illuminating Company of Boston has prepared a brief tabular statement of its generating equipment and connected load as printed herewith, not including the data of the company's extensive distribution system. In view of the rapid growth of the company's load in the past few years these figures are significant of the power supplying possibilities at the disposal of the public in the company's territory.

Number of towns and cities supplied	31
Total area covered	466 sq. miles
Farthest point from L Street station (Hopkinton)	43 miles
Atlantic Avenue Station—	
Number of boilers, 19 hp of each, 368,418; total hp	7,592
Number of engines, 11 hp of each, 650, 1200, 2500; total hp	16,200
Total normal capacity of station in 50-watt equivalents	208,000
L Street Station—Engine Station	
Number of boilers, 12 hp of each, 550; total hp	6,600
Number of engines, 6 hp of each, 2500; total hp	15,000
Total normal capacity of station in 50-watt equivalents	180,000
L Street Station—Turbine Station—	
Number of boilers, 36 hp of each, 512; total hp	18,432
Number of turbines, 5 hp of each, 4 7500; 1 12,000; total hp	42,000
Total capacity of station in 50-watt equivalents	560,000
L Street Coal Field—	
Total storage capacity, approximately	70,000 tons
Total capacity of coal belts per hour, approximately	400 tons
Total Connected Load on System—	
Number of customers	26,265
Number of motors 10,560; total hp	40,678
Number of arc lamps	10,268
Number of incandescent lamps	1,024,026
Total 50-watt equivalents connected	1,747,161
Total normal capacity of all generating apparatus for one hour in 50-watt equivalents	1,114,000

It is interesting to note that the connected motor load now aggregates 40,678 hp, and that the company's coal storage facilities are about 68 per cent of the total annual consumption.

Ventilation in a Telephone Exchange.

An interesting practical example of the benefits of good ventilation in a modern telephone exchange was cited on Sept. 30 at the International Tuberculosis Congress, in Washington, by Prof. C. E. A. Winslow, of the Massachusetts Institute of Technology. Prof. Winslow was discussing the effect of improved ventilation upon the efficiency of factory operatives, carried out under the auspices of the Boston School for Social Workers, and he mentioned the plan adopted by the New England Telephone & Telegraph Company at its Cambridge station. The toll room in the building is long and narrow, with windows at the front and back. In winter, when the windows could not be opened with safety, the air became vitiated quickly. In the spring of 1907 a duct was built along the ceiling, opening to the street at the front, and discharging air into the room by 1¼-in. holes, fans being placed in the rear wall to exhaust the vitiated air from the room. The entire cost of the installation was $75, and a marked improvement in the comfort and general condition of the operators followed this change. In the winter of 1907-8 the average percentage of absences among the 60 odd operators was cut in two. In the three winter months alone this saving amounted to 1.8 times the wages of one operator, equivalent to a profit of $195 for the company, on its capital investment of $75. This emphasized, according to Dr. Winslow, that improved sanitary conditions do bring a tangible return, and sometimes a large one in proportion to their cost.

Meeting of New England Section Illuminating Engineering Society.

The first fall meeting of the year of the New England Section of the Illuminating Engineering Society was held at the Edison Building, Boston, on Friday evening, Oct. 23. Chairman J. S. Codman presided, and about 27 members were present. Copies of all the papers read at the recent convention of the society in Philadelphia were distributed, and a brief summary and discussion of each paper was given by some member who was at present at the convention, after which the paper was thrown open for general discussion. Among the speakers were Dr. Louis Bell, Dr. C. H. Williams, Dr. A. E. Kennelly, Mr. J. S. Codman and Mr. J. W. Cowles.

Process of Making Metallic Filament Lamps.

A patent was issued Oct. 13 to Fritz Blau and Hermann Remane, of Berlin, Germany, on a process for overcoming what is stated to have in the past been a difficulty in making tungsten lamps. The date of application is April 25, 1906, and the patent is assigned to the Auergesellschaft, of Berlin, which company manufactures the osram metallic filament, and is associated with the Austrian company which makes the Osmin tungsten filament. It is stated that the filaments of metallic tungsten lamps are liable to breakage in course of manufacture, due to the adhesion of the filaments to the carrier which serve to guide and support them. This is ascribed to a deposit of the material of the filament on the carriers. The claims are on a process of securing within the bulb a deposit similar to that which the electric current passing through the filament tends to produce, and then to exhaust the bulb. Before the exhaustion of a lamp to produce the usual vacuum is completed, an atmosphere of hydrogen, under a pressure of a few millimeters, is introduced into the globe, and current is then passed through the filament. In a short time an atomizing of the material of the filament occurs in the rarified gases and is followed by the formation of a deposit on various parts of the interior of the lamp and chiefly on the carriers, which will then not adhere to the filament. A very thin film of deposit, causing no appreciable absorption of the light, is quite sufficient to effect the desired purpose.

Indirect Illumination Discussion at Chicago Electric Club.

At the Wednesday noon meeting of the Chicago Electric Club Oct. 21, Mr. A. D. Curtis gave a short talk on indirect illumination as applied by means of inverted reflectors placed in the center of small rooms with light ceilings. It was explained that this method of illumination was made possible in rooms with light ceilings now that tungsten lamps are available if they are combined with reflectors of good reflecting surface and efficient design. A lively discussion followed this address.

Mr. W. H. Blood, Jr., of Boston, opposed indirect illumination as inartistic and unnatural because of the absence of shadows. He claimed that the brilliancy of definite light sources which produce shadows is a condition akin to sunlight, and that without definite light sources we have conditions like those on a cloudy day when everyone feels dull. He also called attention to the fact that reflection from jewelry and cut glass is much better with a definite source of light.

Mr. Francis Barton, architect, said a few words favoring indirect illumination, and expressing the belief that it would be used more extensively in the future. Mr. F. W. Wilcox thought that both direct and indirect illumination had their places, and that there was undoubtedly plenty of room for indirect illumination. Mr. J. R. Cravath explained that when most of the light is reflected from the center of the ceiling in a room there is some direction to the light which overcomes the objection of flatness urged by some against indirect lighting. Mr. W. R. Bonham favored indirect lighting, not only as a system comfortable for the user but as helping the central station and lamp business. Mr. R. F. Pierce, referring to Mr. Blood's remarks, thought that the stimulating effect of the noonday sun was not sought after in our homes in the evening, and that the introduction of exposed light sources, if it produced the stimulating effect stated by Mr. Blood, was not altogether desirable, and that therefore indirect illumination was better for lighting the home.

Fort Wayne A. I. E. E. Section.

The second regular meeting of the Fort Wayne Section of the American Institute of Electrical Engineers was held Thursday evening, Oct. 8. The meeting was preceded by a dinner held at the Homestead Café, at which a large percentage of the members was in attendance and also a number of visitors. The opening of the executive section of the meeting was a discussion as to the custom of having dinners preceding meetings, and it was decided to continue this plan for a short time to find out how successful it would work in practice. The papers for the evening were "Lightning Arresters and Lightning Phenomena," by Mr. Earl B. Hoff, which opened a discussion on this subject, and "Water-Power Development," by Mr. Walter Kent, detailing the recent questions of conservation of water power which have been called to the public attention and the future possibilities of development along these lines. This latter paper called forth a very animated discussion on the part of the members present.

Meeting of the Pittsburg Section, A. I. E. E.

The regular October meeting of the Pittsburg Section, A. I. E. E., was held in the lecture hall of the Carnegie Institute on Oct. 13. Seventeen members attended the informal dinner held at the University Club immediately preceding the meeting. The evening was devoted to the presentation and discussion of two original papers. The subject of the first was "The Oscillograph and Some of Its Uses," by Mr. H. H. Galleher, engineer of the high-tension testing laboratory of the Westinghouse Electric & Manufacturing Company, and the second one was subjected "The Testing of Large Alternating-Current Generators," by Mr. L. E. Schumacher, of the dynamo testing department of the same company. The papers were illustrated by lantern slides. Mr. Galleher's paper dealt with the practical application of the oscillograph to everyday problems, and explained its general construction, operation, adjustment and repairs.

Prof. S. M. Denton, of the Carnegie Institute, supplemented Mr. Galleher's paper with a talk on the application of the oscillograph to the solving of complex problems in phase relation, and showed how essential this instrument had become in large power transmission plants as a means of explaining perplexing phenomena. He advocated the purchase of such instruments by high-tension central stations generally. He then gave an interesting description of the Irwin hot-wire oscillograph, which, he stated, gives great promise as a cheap and sufficiently accurate instrument for such purposes. The subject was further discussed by Messrs. R. P. Jackson, S. M. Kintner and A. W. Copley.

Mr. Schumacher's paper dealt particularly with the tests on the large 8770-kw, 12,000-volt, three-phase generators of the Ontario Power Company, at Niagara Falls, which were tested after erection. The methods of testing and some results were given. The paper was discussed by Messrs. P. H. Lincoln, W. L. Waters, F. D. Newbury and C. Renshaw, special comment being made on the water rheostat and the use of temperature coils to ascertain temperatures in places where thermometers could not be used.

The next meeting will be held early in November, the subject being "Electricity in Mines," by George R. Wood, consulting engineer. This subject is of great interest just at present in the Pittsburg territory.

Schenectady Section of the Institute.

The first meeting of the local section of the A. I. E. E. for the season of 1908 will be held at 8 o'clock on Thursday evening, Oct. 29, at Kinum Hall, 258 State Street, when Dr. E. W. Rice will tell of the pioneer developments within the General Electric Company. Dr. Rice has been connected with the company since its formation, and was earlier with the Thomson-Houston Electric Company, where his work was largely instrumental in the development of various typical machines which are now used in the electrical industry.

On Thursday, Nov. 5, Thursday, Nov. 12, and Thursday, Nov. 19, Dr. C. P. Steinmetz will give a series of lectures on thermodynamics. These lectures are sure to be of special

interest because of the growing importance of steam work in connection with electrical developments.

One illustrated lecture will be given, covering the various developments of incandescent lamps, and another covering the various types and developments of arc lamps. Two lectures will be given on the principles and design of alternating-current commutating motors and one lecture on alternating-current induction motors. One or, possibly, two lectures will deal with direct-current generators and compensating windings. The difficulties met with in heavy railroading, in design and apparatus to take care of high voltages and large powers, will be dealt with in two lectures. An illustrated lecture on the various kinds of radiation, and a series of lectures on light will be given. Lectures will also be arranged for to cover gas turbines, rotary compressors and factory organization.

The officers and committees appointed for this, the largest local Section of the Institute, for the season of 1908 are as follows: Hon. chairman, C. P. Steinmetz; chairman, E. J. Berg; treasurer, E. D. Dickenson (acting treasurer, G. R. Parker); secretary, M. O. Troy; assistant secretary, R. H. Carlton. Executive committee: E. J. Berg, chairman; C. P. Steinmetz, D. B. Rushmore, M. O. Troy. Meetings and papers committee: M. O. Troy, chairman; T. A. Worcester, C. L. Proctor, E. B. Merriam, R. H. Carlton. Finance committee: J. W. Upp, chairman; C. W. Stone, H. G. Reist. Membership committee: E. W. Allen, chairman; F. L. Kemp, E. Karow, J. A. Seede, H. Maxwell, E. E. Kimball. Entertainment committee: A. B. Lawrence, chairman; A. V. Thompson, F. E. Cuddeback, C. H. Hill.

Meeting of Boston Branch of the American Institute of Electrical Engineers.

The first fall meeting of the Boston Branch of the American Institute of Electrical Engineers was held at the Edison Building, Boston, on the evening of Oct. 21, at which Prof. C. M. Allen, of the Worcester Polytechnic Institute, presented a paper on "Field Testing of Water Wheels." Prof. Allen pointed out that the field test of the wheel often clears up disputed points that cannot well be settled by using the generator or other machine driven as a load, since the maker of the generator naturally tends to lay the blame for unfavorable conditions upon the manufacturer of the water wheel, and vice versa. Every plant owner or operating engineer is also willing to make his own check readings when the testing apparatus is installed, and thus abides by the results without question. Prof. Allen described the Alden absorption dynamometer, which is used in his tests, and pointed out a number of features of the different sizes which need to be considered in working the machine.

About 50 tests have been made by Prof. Allen and his associates during the past two years, and in many cases the conditions have been improved to enable the plant owner to secure a larger output for a given volume of water consumed. The wheels tested ranged from 50 hp to 4200 hp in rating. It is much more convenient to test a machine of the larger sizes, say, 2000 hp upward, than to test the smallest units of 100 hp down, although any size can readily be tested with the Alden dynamometer. This dynamometer is practically a hydraulic type of Prony brake. It was found in some tests made that a crack developed around the cast iron hub, but as long as such a crack is not concentric, it need cause no anxiety. The experiment was tried of using steel disks in the dynamometer instead of cast-iron disks, in connection with the regular copper disks, but it was not a success.

Prof. Allen illustrated his address with a large number of lantern slides, showing typical installations of the dynamometer for testing under varied conditions. The Pennsylvania Railroad Company's dynamometer plant for locomotive testing was shown, and the work of the Holyoke Testing Flume discussed. Emphasis was laid upon the point that even if a wheel runner gave good results at the flume, proper setting at the plant was a vital point in the securing of high efficiency and reliability in the field. The wheels must be set far enough apart so that the discharge of one will not interfere with the discharge of another; there must be no leaks, and the water passages must be large enough for good working, while electrical conditions must also be favorable to parallel operation. In one case where a wheel was installed with too little room for the discharges of the plant, it was found that no more power could be obtained at full gate opening than at 80 or 85 per cent of full opening. This meant that possibly 1200 hp in water flow was going to waste constantly. By testing the wheels in place the chance is open to find what is wrong and to correct it if possible.

The ordinary power test can be carried through in about four minutes after the apparatus is set up. An efficiency test may take an hour or more. After the dynamometer is brought to the plant it is usually installed on the shaft just beyond the coupling nearest the water wheel, removing the generator to one side if it is feasible. Prof. Allen stated that in all these tests the weight of the dynamometer, which amounts to several thousand pounds in the larger sizes, is taken off the driving shaft by an arrangement of overload lever arms and counterbalancing weights, which gives the water wheel a clear field. A power plant without a traveling crane is a thorn in the flesh to the testing engineer. Prof. Allen concluded by discussing the difficulties encountered in making tests in a great variety of industrial installations, and showed by his slides how the equipment was installed in each case, including transportation to and from the plant, erection and conduct of tests under emergency conditions. The apparatus can generally be installed in a very few hours.

CURRENT NEWS AND NOTES.

REPUBLICAN PARADE.—The engineering professions in New York City are proposing to participate in the big Taft business men's parade on Saturday, Oct. 31. A large contingent is expected from the electrical engineers and companies, which have been invited to march in this division. The engineering section of the parade will form on Liberty Street at Broadway and is timed to leave at 1 p. m. Theodore Dwight, 15 Broad Street, is doing the work of organization and he will be glad to hear promptly from those who wish to participate.

CONSOLIDATION OF JOURNALS.—The announcement is made, confirming rumors that have been current for some time, that the *Electrical Review*, of New York, has purchased the *Western Electrician*, of Chicago, and that the combined journals will be published hereafter at Chicago under the name of *Electrical Review and Western Electrician*. The first issue of the new publication will be dated Nov. 7, 1908. President Charles W. Price says in his formal notice: "The present form of the *Electrical Review* will be continued, and there will be no change in the personnel or management."

BUDAPEST CONFERENCE.—At the close of September an international conference was held at Budapest, composed of the engineers of the various government telegraph and telephone administrations of Europe. There were about 50 official delegates present, although the three from France were called home abruptly by the fire in the large telephone exchange at Paris. The conference lasted 10 days. The countries of England, France, Germany, Austria-Hungary, Italy, Russia, Sweden, Denmark, Holland, Turkey, Bulgaria, Roumania and Servia were represented. A number of papers were read and discussed dealing with telegraphic and telephonic subjects, such as automatic and semi-automatic telephone systems, telegraph systems, types of telephone cable, telephonic transmission, telegraph switching systems, etc. The Hungarians entertained the convention royally, and the affair closed with a banquet given by François Kossuth, Minister of Commerce. The new engineer-in-chief of the British Government telegraphs, Major W. A. J. O'Meara, presented a paper on the underground cable system of the British Isles.

OHIO ENGINEERS.—The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its next meeting at Toledo, Nov. 20 and 21. Some unusually interesting features it is stated will be brought out at this meeting, and a large attendance is looked for in consequence. Mr. David Gaehr, Schofield Building, Cleveland, Ohio, is secretary of the society.

THE INTERNATIONAL COMMISSION.—According to the advices from England it is practically certain that Prof. Elihu Thomson is to be the new president of the International Electrotechnical Commission now meeting in London, and of which, under its name of the International Conference on Electrical Units and Standards, Lord Kelvin was the first president. This news, if confirmed, will certainly afford a great deal of gratification in America. The meeting place is the new home of the Institution of Electrical Engineers on the Thames Embankment.

DENVER POPULATION.—It is a very interesting commentary on modern central station methods that the daily newspapers in quoting lately the growth of population in Denver, Col., showing that nearly 2000 families have gone there in the last seven months, give the Denver Gas & Electric Company as authority for the statistics. The company in watching for "prospects" keeps a closer eye, it would seem, on the movement of population than the regular municipal authorities, or has its data in more available form. Incidentally, the evidence of the company's enterprise does it no harm.

PUNISHING THEFT OF CURRENT.—At Roanoke, Va., on Sept. 28, a man named Yonce Wilson, who claimed to be an electrician from Bristol, Tenn., was arrested at the instance of the Roanoke Railway & Electric Company for tampering with its wires and meters. This man approached certain of the customers and offered to so arrange the wiring that they could cut out the meter whenever they so desired and still use the current. One of the persons approached by him reported the matter to the company, which turned the case over to a local detective agency. This agency investigated the matter and got two of the customers to let Wilson do the work he had proposed. He was arrested while at work on the second job, and was punished with a fine of $30 in the police court, and given 30 days in jail as well. The plan was to have the customer leave the switch out one-third of the month, thus reducing his bill in the same proportion, without making difference enough to cause any suspicion on the part of the meter reader. The shunting wires were concealed in cracks, and where connections were made at the back of the switch they were concealed under the regular wiring.

FOREST FIRES.—Mr. Gifford Pinchot, chief of the Forestry Bureau, in speaking of the fierce forest fires this year, said last week: "The whole northern half of the country has been attacked and the losses represent a serious drain on our timber supply. Besides destroying valuable timber and other property, the fires which have been raging during the last few weeks in the East have caused an almost incalculable loss to watersheds of important streams supplying power for countless industries. In the Adirondacks the destruction has resulted in marring one of the nation's most useful playgrounds. There is little or no difference between the fires of 1908 and those of other years so far as causes are concerned. Unfortunately there is little difference in the way people have met them. In most States the fires have been allowed to run until they have threatened valuable property and only then efforts were made to check them. The forest fire question resolves itself into one of the most important problems before the nation in the care of its national resources. Success or failure in its solution by those having private holdings of timberlands means the continued use of the land or the perpetual burden of caring for barren wastes."

UTILITIES IN CLEVELAND.—The citizens of Cleveland have voted down the Johnson plan of street railway operation. At a meeting of the board of directors of the Cleveland Railway Company on Oct. 24 it was announced that immediately upon regaining possession of its system of lines in this city a rate of fare of seven tickets for 25 cents, with universal transfers and double transfers on all crosstown lines, would be put into effect. This rate of fare will also include the suburbs. The Municipal Traction Company has as yet made no official reply to the demand of the Cleveland Railway Company that it surrender the entire traction system which it is now operating. This demand was made yesterday as soon as it became definitely known that the people had rejected the three-cent fare franchise. This action was taken in accordance with a provision in the lease to the holding company, wherein it was agreed that the property should revert back to the owning company in the event that the franchise was not approved. Mayor Johnson had recently announced his intention of "going after" the Cleveland Electric Illuminating Company, and Mr. S. Scovil dared him to come on. The vote of the citizens against him will probably tend to check the Mayor in his display of animosities.

THE BIDWELL SWINDLE.—At Chicago on Oct. 24 Benson F. Bidwell, who is 73 years of age, and his son, Charles, were sentenced to a term of from one to ten years in the penitentiary by Judge Chetlain. They were charged with having obtained hundreds of thousands of dollars by means of a swindle revolving around a "cold" electric motor. The two Bidwells asked for more time in which to secure money to take the case to the Supreme Court, but the court pronounced sentence. However, the prisoners will be kept in the county jail for a time to allow them a better opportunity to secure funds with which to fight further. The elder Bidwell, when asked by the court if he had anything to say, answered: "I say honestly that I have never stolen a dollar or one cent of the Bidwell Electric Company's money. They charged me with the same thing in Philadelphia when I invented the trolley car, but now it is running in every city in the world. I invented the electric fan, but, being too poor to take out a patent, I was deprived of the fruits of my work. The cold motor will develop just as well, and it will be used throughout the world after I am under the sod and forgotten." This swindle has often been referred to in the Electrical World, on account of the lying advertisements offering the stock for sale, carried in some of the most reputable daily newspapers in the country.

THE STEAMSHIP "GEORGE WASHINGTON" of the North German Lloyd will be launched at Bredow, Germany, on Oct. 31. She is over 722 ft. long, and has 78 ft. beam, with displacement at 33 ft. draft of 36,000 tons, and with four reciprocating engines of a total indicated 20,000 hp. She has seven electrical generators, 4100 electric lights, 24 electrical ventilators, electrical bulkhead doors closing in 15 seconds, a large number of staterooms heated by electricity, electric bells in all staterooms, a complete telephone system, boat and provision winches operated by electric motors, and a wireless telegraph system. Safeguards for the ship and passengers include a bell system for fire-extinguishing purposes with 14 alarm bells leading to the main quarters of the crew; a complete alarm-bell system with 30 bell stations for the ship and engine-room system; a fire-reporting system, with 18 fire-alarm stations scattered over the vessel; submarine bell signaling apparatus, permitting the ship's officers to know of the proximity of another vessel or coast when from 7 to 12 miles distant. This system is of benefit in enabling the ship's officers to keep to their course when approaching or leaving port in foggy weather. There is suspended at the stern a life buoy which can be dropped overboard by the turning of a switch on the bridge. There are also engine telegraphs, rudder telegraphs, etc., In connection with the wireless telegraph station a daily newspaper will be published on board, giving the important happenings from both continents.

The Caracas Electric Railway.

CARACAS, the capital of Venezuela, is the ninth in size of the 20 capitals of America, and was founded in 1564, some 60 years after the settlement of La Guaira, only 10 miles away on the coast. Though well within the tropics, its climate, owing to the city's elevation of nearly 3000 ft., is salubrious, and the average temperature is about 70 deg. Fahr. Seen at first from the top of the pass leading from La Guaira to the capital, Caracas looks like a flat, level city of white plastered walls and red-tiled roofs, broken on all sides with green. Actually, there is a difference in altitude of over 500 ft. between the northern and the southern ends of the city. The population of Venezuela is about 2,500,000, of which about 80,000 inhabit Caracas.

During the last 10 years Caracas has come into prominence through the faculty of the president of Venezuela, Cipriano Castro, of getting into difficulties with pretty nearly every foreign power whose citizens have interests in Venezuela.

Previous to the year 1905 there were two small horse railway companies in operation in Caracas. One was the Bolivar, running east and west from the station of the Central Railway to that of La Guaira and German lines. The other was the Caracas Tramway Company, which, starting from the Plaza Bolivar, radiated out to the different quarters of the city. In 1905 the two companies were combined under the presidency of Dr. Zuloaga, a leading member of Caraquenian society, and the directorship of Edgar A. Wallis and Albert Cherry, two of the most prominent members of the British community. A concession was obtained from the municipal authorities with a view to the electrification of the whole system, and E. H. Ludford, formerly manager of the Bolivar Company, was appointed general manager of the whole. Mr. Willis then went to London, where he interested English capitalists in the scheme, on which J. G. White & Company, Ltd., drew up a full report. Their recommendations were accepted, and a contract was drawn up whereby the company undertook to supply a complete equipment, including track, office buildings, car house, power station and plant and cables. Work was started in the spring of 1907 and completed by February, 1908.

The routes selected, with a total length of 10 miles, were practically those of the old companies. These naturally converged into the Plaza Bolivar, the center, political and social, of the city, in which and around or near which all the ministerial and government buildings are situated. From this point as a radius, the lines extend north, south, east and west. The maximum grade is 4 per cent.

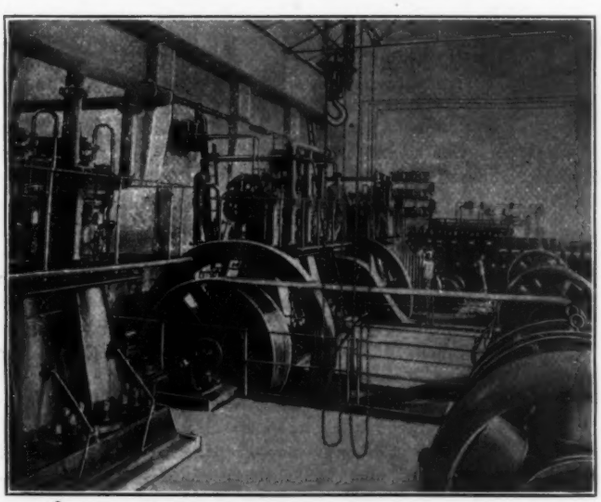
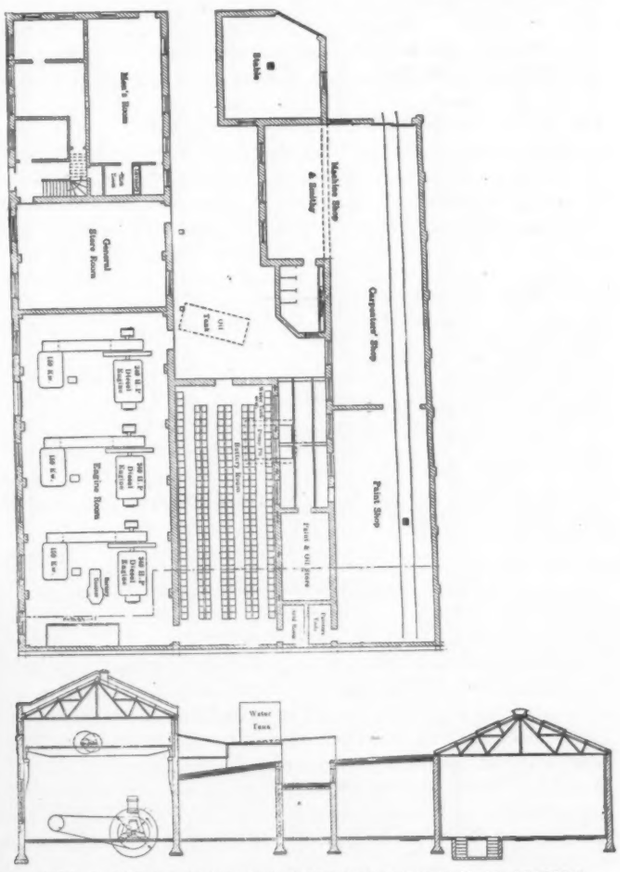


FIG. 1.—VIEW OF INTERIOR OF CARACAS POWER STATION.

The overhead construction consists principally of side poles with cross bracket arms. Only tubular poles are employed, of which 450 are of the Grand National type. The rest of the poles are 31 ft. in length and are of British standard pattern. All were supplied by Stewarts & Lloyds. The bracket-arm tubes are 2⅜ in. diameter. The feeder boxes, supplied by Estler Brothers, are three in number, and are fitted with 250-amp quick-break switches; the section boxes, 14, with 100-amp quick-break switches. The trolley wire is of the No. 00 B. & S. grooved type.

The feeder cables, some four miles in length, are all aerial, and are suspended from cross-arms on the poles above the brackets. They are all of pure aluminum, with a size of 0.33 sq. in. and 0.25 sq. in., and have a conductivity of 60 per cent of that of copper wire with a conductivity of 99 per cent of Mathiessen's standard of pure copper. They were supplied by the British Aluminum Company and covered by the Silvertown India Rubber & Gutta Percha Company with triple-braided weatherproof insulation and compounding over all.

The power station, office buildings, car house and manager's residence are all built on one site on the north of the Avenida Este, and are of brick. The car house is situated at the back



FIGS. 2 AND 3.—PLAN AND CROSS-SECTION VIEWS OF STATION.

and contains five tracks, two of which have a pit and are supported on iron columns. The floor and pit are concreted. The frontage is taken up with the office buildings and the power station, over which is the manager's dwelling. The office quarters are all on the ground floor and are subdivided into manager's, clerks' and accountants' rooms, and men's waiting room. The roof over the shops has been adapted to serve as a roof garden for the manager and his family, and provides a cool and pleasant place of retreat in the tropical evenings. The rest of the road frontage is taken up with the engine room, with a length of 44 m, a depth of 11 m and a height of 10 m, while behind the engine room is the battery room with a floor area of 19 m x 7 m, and the machine, carpenters' and other needful shops, the whole making one compact and self-contained system.

There are two aspects from which the power house may be regarded, either as a substation for a high-tension current or again as an independent producer. As a substation it is em-

ployed to transform from 4500 volts to 500 volts. The high-tension alternating current is obtained from the Electrical Company, of Caracas. This company has two stations at Encantado and Los Naranjos, about 16 km from the capital. There are four generators at each station and more machinery is now being introduced. The motive force is the water of the Guaira River, which has a fall of 38½ m and 154 m at Encantado and Los Naranjos, respectively. During the day the energy is supplied by the Electrical Company.

In the evenings, however, when the town is lighted electrically, and also during stoppages which may occur occasionally, the energy is produced in the power house itself. This is effected by three Diesel engines of 240 hp each running at 180 r.p.m. The Diesel engines were selected on account of the high price of coal. They have, moreover, an additional advantage in that no delay need occur in starting them; an advantage which is obvious in the case of a sudden interruption of the high-tension transmission. The engines are belted to three motor-generators. On the induction motor side these are designed for 5000 volts, three phase, with 50 cycles, while in the direct-current side they yield an output of 150 kw at 550 volts at a speed of 500 r.p.m. The station is also furnished with a battery of 260 Tudor cells, with a capacity of 520 amp for one hour and 252 amp for three hours, the maximum charging current being 252 amp. The Lancashire Dynamo & Motor Company supplied one of its automatic reversible boosters. The regulation with the battery and booster is such as to keep the load on one or two generators operating in parallel (i. e., 150 kw or 300 kw at 550 volts) constant within 8 per cent over or under the normal load of 272 amp or 544 amp, provided the maximum load does not exceed 100 per cent of the normal load of the set or sets running. In case of 150 per cent overload, the variation does not exceed 10 per cent, and in case of 200 per cent overload the variation does not exceed 12 per cent.

The switchboard consists of 10 panels, viz., one high-tension incoming feeder panel three-phase, 5000 volts between wires. Three induction motor panels; one battery and booster panel; three direct-current generator panels, and two feeder panels, all fitted with the necessary instruments. The board and motor generators were supplied by the General Electric Company, of New York.

The Fatigue of Insulation.

By A. S. Langsdorf.

The experiments of Wöhler[1] on the effect of repeated stresses in metals showed long ago that a progressive weakening or fatigue of the material resulted therefrom, as indicated by the fact that breakdown could be effected by the repeated application of a load much below that which the specimen would carry if the load were gradually applied. More recently similar experiments[2] on concrete showed conclusively that this material is subject to the same fatigue. It therefore seemed reasonable to suppose that insulation subjected to the rapidly reversing stresses due to an alternating electromotive force would likewise exhibit this property, and the series of tests described below was accordingly planned to investigate the matter. That a fatigue effect existed was indicated quite clearly by observations already on record in various publications, among which it is here sufficient to refer to the paper by Mr. J. S. Highfield on "The Transmission of Electrical Energy by Direct Current on the Series System."[3] In this paper it was shown that a given kind of insulation is capable of withstanding for long periods a steady electromotive force of much higher value than the alternating electromotive force, which produced almost instantaneous rupture. Heretofore, however, definite data on the subject seem to have been lacking, and the following facts are presented in the hope that others may continue the investigation in greater detail.

[1] "The Materials of Construction," J. B. Johnson. 1st ed., p. 539.
[2] "The Fatigue of Concrete," J. L. Van Ornum. *Trans.*, A. S. C. E., vol. 58, p. 294.
[3] *Jour. Inst. Elec. Engrs.*, vol. 38, p. 471.

The progressive breakdown of materials under varying or alternating stress is commonly attributed to the gradual weakening of the bond between adjacent particles, or to the development of flaws that may have originally existed. At any rate, it is known from the behavior of steel and concrete that the stress producing rupture is definitely related to the number of repetitions of that stress. It was expected, therefore, that the difference of potential producing rupture in the case of an insulator would be equally as definitely related to the frequency of the supply circuit; or, with a given frequency, to the duration of application of the electromotive force. The tests here described are, accordingly, of two kinds:

(a) *To determine the relation between the rupturing electromotive force and the duration of application, the frequency being constant.*

(b) *To determine the relation between the frequency of the alternations and the time required to produce breakdown, the applied electromotive force being constant.*

The tests were made on three different kinds of insulation, namely, Empire cloth (7 mils in thickness), varnished pressboard (25 mils) and flexible micanite (10 mils). In each case the samples were 6 in. square, and they were tested between electrodes 3 in. in diameter, the latter having the usual rounded edges. It is interesting to note that the great majority of the samples failed inside the edges of the electrodes.

The method used in obtaining the data will be evident from an inspection of Fig. 1. Five standard lighting transformers,

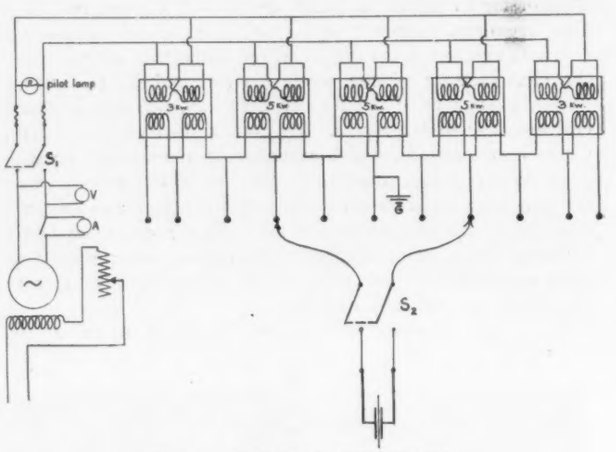


FIG. 1.—DIAGRAM OF CONNECTIONS.

three of 5-kw rating and two of 3-kw rating, each transforming from 110 or 220 volts to 1100 or 2200 volts, were connected with the low-tension coils in parallel and the high-tension coils in series. The connections between the latter coils were brought to a terminal board, as indicated, and the middle point was permanently grounded. In the majority of the tests the low-tension supply electromotive force was maintained nearly constant at 100 volts, and variations of the high potential were made by steps of 1000 volts by simply changing the position of the leads on the terminal board. This was done for the purpose of keeping the wave-form of the electromotive force constant. Variations of the electromotive force smaller than the 1000-volt steps were made, when required, by adjusting the field rheostat of the alternator supplying the electromotive force, oscillograph records having shown that the wave-form did not change appreciably within the limits of the voltage regulation used. The alternator was a 15-kw revolving field machine, whose electromotive force wave, when giving 100 volts, was as shown in Fig. 2. In this wave the ratio of maximum to effective value is 1.69.

In making a test of a sample of insulation, switch S_1 was first closed, and the impressed electromotive force was adjusted to the desired value. Switch S_2 was then closed sharply, and the time required to produce puncture was noted on a stop-watch. It was found that the charging current taken by the test specimen was too small to affect the electromotive force;

the voltmeter on the low-tension side was absolutely unaffected by the closing of S_2, and several oscillograph records of the voltage on the high-tension side showed no break in the continuity or amplitude of the waves. Fig. 3, for example, is such an oscillograph record, the closing of S_2 having occurred between the time of starting the exposure and the sudden drop

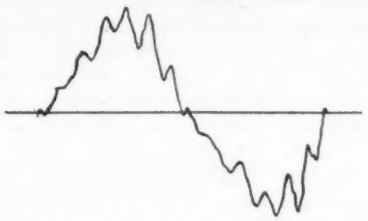


FIG. 2.—E.M.F. WAVE, 100 VOLTS (EFFECTIVE).

in the electromotive force due to puncture. It was further established by measuring the short-circuit impedance drop of the transformers that the ratio of transformation was substantially equal to the ratio of turns; the impedance drop, under the conditions obtaining in the tests, was less than one-half of

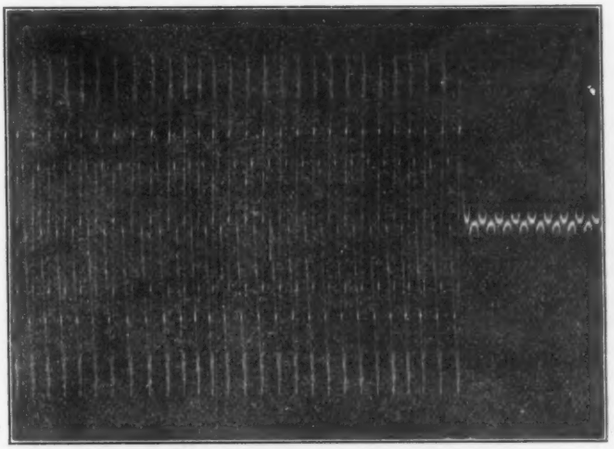


FIG. 3.—OSCILLOGRAPH RECORD OF BREAKDOWN.

1 per cent, or entirely negligible in comparison with the much larger errors of observation in determining the time of breakdown.

Measurements of the kind here described naturally require

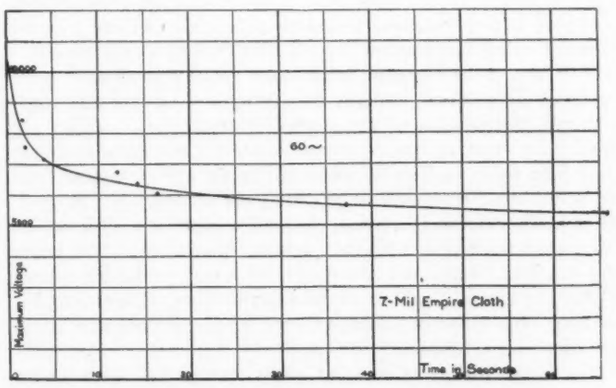


FIG. 4.—TIME TESTS ON EMPIRE CLOTH.

a large number of observations in order to obtain reliable average results. Individual samples of insulation frequently show wide variations from the mean, especially when the applied electromotive force is near the "instantaneous" breakdown value. For this reason 20 observations were taken to determine points in the upper and middle ranges of the curves of Figs. 4, 5 and 6, while 10 observations were found to be sufficient in the tests requiring a relatively longer exposure to the electromotive force.

In addition to the tests on the three materials reported upon, several runs were made with plain—that is, unvarnished—fuller-board. It was found, however, that the results were unreliable, due to the excessively hygroscopic character of this

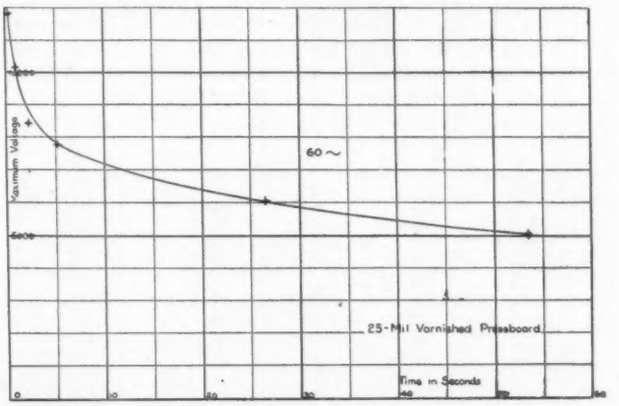


FIG. 5.—TIME TESTS ON VARNISHED PRESSBOARD.

material; while the results, in the main, were similar to those found in the case of the other three materials, data obtained on different days, or even at different times of the same day, exhibited marked irregularities, presumably on account of varying moisture conditions. Irregularities were also found in the other materials, but they were much less pronounced and could be attributed to accidental defects in structure.

The curves of Figs. 4, 5 and 6 show the results obtained when working at a constant frequency of 60 cycles per second. Fig. 7 shows the results of a run at constant voltage, but with variable frequency, the material used being Empire cloth; similar tests on the other two materials were omitted because of lack of time. There is no reason to doubt, however, that they would yield similar results.

Figs. 4 to 7 bring out the fact very clearly that the ultimate strength of the insulation is a function of the number of alternations of the electrostatic stress. Just what the function is,

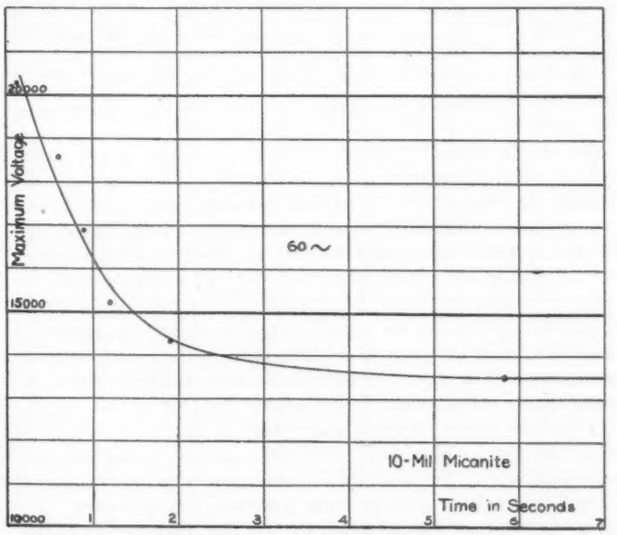


FIG. 6.—TIME TESTS ON MICANITE.

in mathematical terms, has not yet been determined, but sufficient work has been done to establish the fact that the equations of the curves are by no means simple. The probability is that the voltage-time curve is of logarithmic nature, but thus far it has been impossible to find an equation that will fit the entire range of observations. The curve of Fig. 7 is of hyperbolic nature, though not exactly an equilateral hyperbola. It indi-

cated, however, that there is a tendency toward a constant value of the product of frequency and time; in other words, if the applied electromotive force is above a critical value, breakdown occurs after a definite number of repetitions of the electrostatic stress.

It is hardly necessary to call attention to the fact that these results show conclusively the danger of subjecting the insulation of a machine to too severe a test. The conclusion may be drawn from the curves here shown that the real strength of the insulation, at least of the kinds used in the experiments, is approximately half that shown by an instantaneous breakdown test, and the proper factor of safety must be based upon the "asymptotic voltage" of the curves. Otherwise expressed, the experiments show that if the dielectric strength is to be measured in the usual way by bringing up the voltage from zero, the voltage should be raised gradually. The shape of the curve in Fig. 7 seems to indicate that a high-voltage test on a finished machine should be made with a low-frequency electromotive force rather than a high-frequency one, if permanent damage is to be avoided; certainly the test frequency should not exceed the normal working frequency of the machine itself.

There is a further question concerning the possible damage done by a severe high-voltage test that can only be answered by additional tests of a character similar to the above. It relates to the weakening effect of prolonged application of an

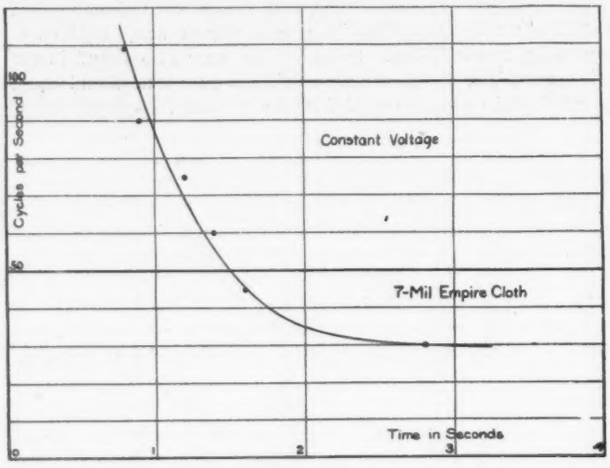


FIG. 7.—CURVE SHOWING RELATION BETWEEN FREQUENCY AND TIME.

electromotive force which is yet low enough to avoid actual breakdown. Obviously, an electromotive force less than the asymptotic value may be applied indefinitely without harm; but if the electromotive force is above this critical value, and is applied for a less time than that required to produce puncture, it would seem from these results that a lowering of the instantaneous strength, and indeed of all that part of the curve above the knee, might be expected; so that a second application of this voltage, or perhaps a lower one, whether accidental or otherwise, might cause breakdown. It may be added that preparations are being made to investigate this matter.

The results here recorded were obtained, under the direction of the writer, by Mr. M. K. Toeppen, who undertook the work as a graduation thesis. Lack of time prevented a more complete investigation than is here reported, but the writer desires to express his appreciation of the conscientious and enthusiastic manner in which Mr. Toeppen did the work. At the conclusion of the work our attention was directed to the fact that tests of a similar or identical nature have been recently undertaken by the National Physical Laboratory of Great Britain.

In conclusion, the writer desires to extend his thanks to the Wagner Electric Manufacturing Company and to the Dielectric Manufacturing Company for their courtesy in supplying the materials tested, as well as some of the apparatus.

Measuring the Slip and Speed of Induction Motors.

By Chas. A. Perkins, Ph. D.,
Professor of Electrical Engineering, University of Tennessee.

Three years ago the writer published* an outline of a slip-indicator which has been so satisfactory that he believes a description of its design and operation will be welcomed at this time.

The apparatus consists of a strip of sheet iron ½ in. wide, clamped at one end to an iron support, and of such length that its rate of vibration shall be slightly greater than the frequency of the current which runs the motor. A light rider sliding on the strip brings the period of vibration into synchronism with the current. Just below the strip, and supported on the same base, is an electromagnet with its pole just far enough away to allow the strip to vibrate freely. This is connected across the alternating-current mains. The magnet of an ordinary electric bell may be used if placed in series with an incandescent lamp, and the lamp will at the same time be useful for lighting the vibrating strip.

On the end of the motor whose slip is to be determined is fastened a cardboard disk, which has a radial slot of generous width near its outer edge. The strip, vibrating in synchronism with the current, is placed near the motor in such a position that it may be seen through the slot in the disk (at some point in its rotation). Thus, when the disk rotates with the shaft, one views the strip once for each rotation.

If the motor runs at synchronous speed, the strip will be seen once in each vibration with a two-pole motor, at every second vibration with a four-pole, etc., but always at the same phase of its vibration, so that the strip will seem to be standing still. If, however, the motor runs at a less speed, slipping back by one pair of poles, or one cycle, per minute, the strip will seem to make one complete vibration in the same time. The number of apparent vibrations in any time is equal to the number of cycles lost by the motor during the same time.

For 60-cycle current and a four-pole motor, one slot in the disk is sufficient. If with slower speed the strip seems to flicker, the slot may be made narrower, and as many slots may be used as there are pairs of poles. By this device one can count the slip, without special practice, up to 150 or 200 cycles per minute.

To find the frequency of the driving current it is customary to take the speed of the motor by an ordinary speed counter, and correct this for the slip of the motor as determined by the above process. The author has long felt that the speed counter is one of the most prolific sources of error in testing, and that some simple and inexpensive device should be adopted corresponding in accuracy to the slip indicator. It occurred to him that if the vibrating strip in the above arrangement were replaced by a tuning fork, it would be easy to find the "slip" between the rotation of the machine and the frequency of the fork. As most of the alternating-current machines available had four poles and were designed for 60 cycles, a fork was made having a frequency of 30 cycles per second. If this fork, electrically driven, is viewed through a slot in a disk which rotates on the end of the shaft, it will seem to stand still when the machine rotates at a speed of 1800 r.p.m.; while for speeds higher or lower it will seem to vibrate more or less rapidly, making one apparent vibration each time the machine gains or loses one revolution.

The same fork will seem to stand still if the shaft makes 900, 600, 450, 300, etc., r.p.m.; that is, at any of the speeds of 60-cycle machines. At the lower speeds, however, the views of the fork will be so infrequent that it will seem to flicker, and it will be necessary to have more than one slot in the rotating disk. A six-pole machine may have three slots, an eight-pole two or four slots, etc.

As it is quite possible to count 150 apparent vibrations per minute, this same fork may be used to determine all speeds

*Trans. A. I. E. E., Vol. 24, p. 879.

from 1950 to 1650, 975 to 825, 650 to 550, etc. If the same method is to be applied to all machines, it will be necessary to use two other forks of 25 and 20 vibrations, respectively. Then, by choosing the proper fork, it will be possible to measure any speed up to 1950 r.p.m.

It is noteworthy that simply for adjusting speeds in alternating-current tests this device has been of great value. Its only drawback has been an immediate increase in the demand for more finely divided rheostats for regulating the driving motors. However, even where the speed of the machine is not under control, the fork gives the actual speed, and in the case of varying speeds it indicates the proper instant for making the readings.

The fork has the disadvantage of not indicating clearly whether the correction is to be added or subtracted. At first it will be necessary for an observer to ascertain the effect of slightly braking the machine in order to see whether this increases or decreases the apparent vibrations, but one soon learns to judge of the speed relations by the shape of the prongs of the fork. The electromagnet attracts the prong at one point only, and this part is drawn in more rapidly than the rest. The curvature of the fork is therefore different when approaching and when receding from the magnet. By noticing whether the fork is concave or convex in the direction of its motion, one may judge the relative speed of the fork and shaft.

Development of the Alden Absorption Dynamometer.

By G. EVERETT QUICK.

The absorption and accurate measurement of mechanical power, especially in large quantities, has always been something of a problem. The more frequent testing of commercial motors of various types for efficiency and maximum power has led to an effort toward the development of an absorption dynamometer having better regulation and greater capacity than the commonly used Prony brake. As all who have used the latter well know, to remove the heat generated so that the temperature of the brake will remain somewhere near constant is a difficult task, especially with large units. This, together with the variable lubrication of the frictional surfaces, sets up vicious vibrations, which are transmitted to the weighing device, and poor regulation and inaccuracies are the result.

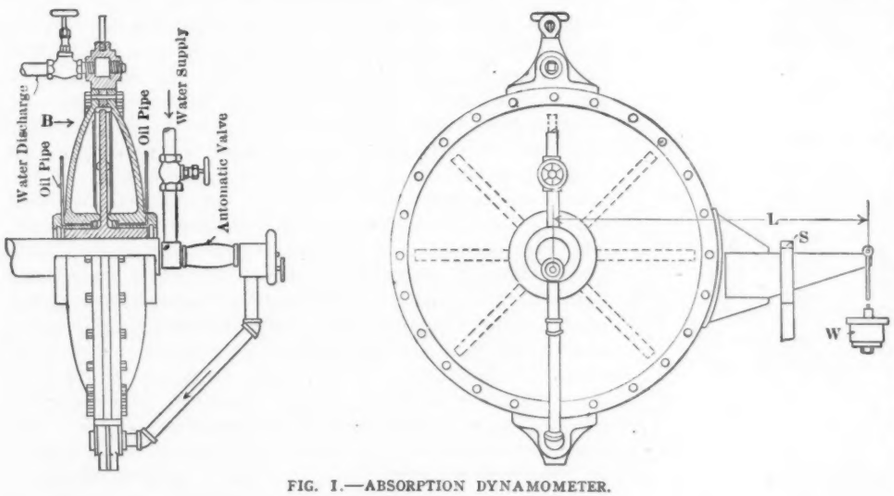


FIG. 1.—ABSORPTION DYNAMOMETER.

Numerous dynamometers have been invented, based on widely differing principles, and under certain conditions some are giving much more satisfactory results than the Prony brake. Among these are the rope brake, electric dynamometer (cradle type) and the Alden dynamometer. The latter is best known to engineers and manufacturers in its single-disk form, built for low and medium powers. More recently this brake has been developed to measure large powers without increasing the number of units.

Improvements by the inventor, Mr. W. I. Alden, assisted by Prof. Chas. M. Allen, of the Worcester Polytechnic Institute, have made it mechanically possible to build a single brake which will satisfactorily absorb the power generated by the largest motors in use at the present time. Although the large units thus far built have been used principally in tests of water wheels, the results will be equally as satisfactory when testing motors running from other sources of power.

Briefly, the Alden brake in its simple form, Fig. 1, consists of a smooth circular revolvable cast-iron disk keyed to the shaft which transmits the power; a stationary casing having its bearings on the hub of the disk; and a pair of flexible copper plates, in frictional contact, one on each side of the disk. These copper plates are integral with the casing and form the two water-tight compartments. In its improved form for high powers, the number of disks is greater than one and the number of water compartments correspondingly increased. Through a system of piping, water under pressure is circulated through the compartment between each unit, and also the two outside compartments. The water pressure serves the double purpose of regulating the load by controlling the pressure between copper plates and revolving disks, and by its circulation, removing the heat through a throttled outlet. To reduce wear of the friction members and to aid the smooth action of the brake, oil is circulated between the disks and copper plates. In low-powered brakes the oil is admitted near the hub, and by its centrifugal force follows radial grooves in the disks to the circumference, where it is collected and used again. In large units, the lubrication being more particular, oil enters at the circumference under pressure, is forced through the radial grooves and completes its circuit to the pump by hose connections at the hub.

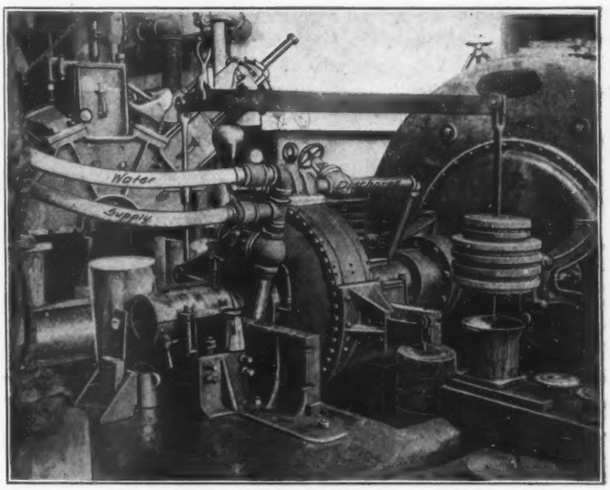


FIG. 2.—GENERAL VIEW OF DYNAMOMETER.

The power, transmitted from the motor under test, tends to rotate the housing, which tendency is counterbalanced by the weights, *W*, suspended from the lever arm attached to the housing, and kept within prescribed limits by the double stop, *S*. In its original form for low powers only one counterbalancing arm was used, but with large units the weight of the casing caused hot bearings and inaccuracies in the test. Another

lever, *M*, and an outside arm, *N*, with weights, *W* (Figs. 2 and 3), were added to counterbalance the weight of the dynamometer. By properly distributing the weights and proportioning the levers the weight of the shaft, as well as that of the dynamometer, can be taken from the bearings and suspended at the fulcrum *O* of the outside arm. The levers are so proportioned that in operation the outside scale indicates 1 hp for 1 lb. weight per 100 r.p.m., and the inside scale indicates 1 hp for 10 lb. of weight per 100 r.p.m.

The capacity of the dynamometer is dependent on the amount of heat that can be transmitted through the copper plates, the kind of oil used and the water pressure available. Since the maximum peripheral speed of the disk should not exceed 7000 ft. per minute and the best friction surface is between 6 to 10 sq. in. per horse-power, the large capacity brakes require more than one disk. A cheap grade of oil with a high viscosity is suitable for heavy work.

A feature of this brake, not by any means the least important, is the ingenious water valve, by means of which the water

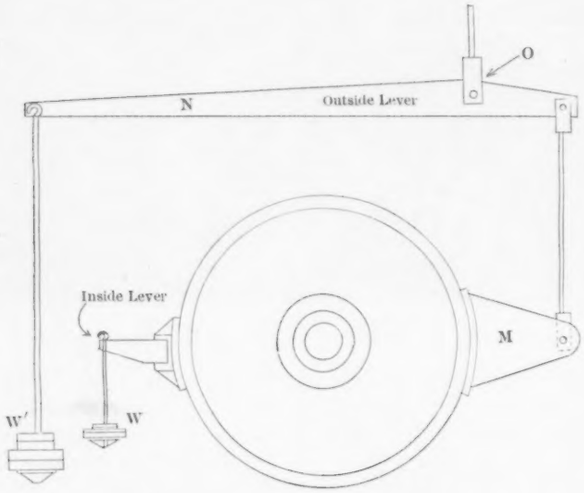


FIG. 3.—LEVER SYSTEM AND BRAKE.

pressure within the brake, and consequently the load, is automatically maintained constant. The slight motion of the brake casing between the limits of the stop, *S*, due to an unbalancing, opens or closes the water inlet valve which is on the same axis. A low-water pressure is sufficient for low powers, but 40 to 60 lb. per square inch is required for large units.

The Alden dynamometer in its multiple-disk form has been used by Professor Allen in testing large water-wheel units, and he has accomplished with this brake what is said never to have been done before in weighing up power of units exceeding 2000 hp. Fig. 2 is a cut of a 60-in., four-disk brake in the bearings of a pulp-grinder and direct connected to the water-wheel. It is absorbing 3000 hp, operating at a speed of 225 r.p.m.

The steadiness, compactness and flexibility of this type of dynamometer will give satisfactory results where the Prony brake cannot be used. By increasing the number of disks there is apparently no mechanical limit to its possible capacity.

Steam Turbine Operation.

The discussion at the Atlantic City convention of the railway associations on that part of the report of the committee on power generation dealing with the practical operation of steam turbines brought out those points in which the steam turbine is said to excel:

Mr. Charles Hewitt said that the Philadelphia Rapid Transit Company has seven different designs of turbines of various sizes, made by three different manufacturers, and there is a wide variation in economy in the pounds of coal per kw-hour in the different turbines, due to the difference in size, the difference in design and the difference in conditions. Hence, it was difficult to submit a categorical reply to a question as to the efficiency of a turbine. This condition affects more or less all the questions on turbines. He believes the greatest economy can be secured with an exhaust-steam turbine in connection with a well-designed reciprocating engine greater than that of any straight turbine plant that could be built. He understands that one of the large trans-Atlantic companies is designing, or has put into service, a steam vessel built on these lines.

Mr. Roberts said that much of the information given in the report was obtained from well known authorities on the topics treated, but that their personalities could not be made known from business reasons. Further, the committee was necessarily somewhat handicapped in certain replies, especially the use of turbines and reciprocating engines in the same plant, by the fact that the turbines are in almost every instance confined to a smaller part of the operation of plants than the reciprocating units. His own plant contains a 500-kw and a 2000-kw direct-current turbine unit and a 1500-kw turbo-alternator. On the other hand, the company has reciprocating engines possibly four times as powerful as all the turbine units placed together, so that while it has been making observations on the operation of the turbines, he could not compare exactly reciprocating units and turbines of the same size. He is impressed, however, with the overload capacity of a steam turbine in good condition, with a good head of steam and a reasonable amount of superheat. There seems to be almost no range of power within the possibility of the strength of the material of which the turbine is constructed at which the turbine will not work.

Mr. Richard H. Rice, of the General Electric Company, expressed his hearty appreciation of the great value of the study which the committee had given to the practical operation of steam turbines as compared with reciprocating engines in power stations. Information of the kind contained in the report is of the utmost value from the manufacturers' standpoint. It is only from the people who are operating the apparatus that they can derive the necessary information for the improvement of the apparatus. Far from feeling that criticism is detrimental to business, they believe it to be of inestimable value. In getting the information the committee has been brought face to face with almost insuperable difficulties. Unless two plants are compared which are giving the same output and which are entirely separate, it is almost impossible to obtain data in steam consumption which will be of very great value. Obviously most street-railway plants are not so situated that this comparative information can be obtained. On the whole, however, the consensus of opinion seems to be favorable to the steam turbine, and the speaker believes that future reports of the committee will be still more favorable to the turbine because some of the units reported on are among the first shipped. Certain types of steam turbines, particularly the impulse type, give an increased efficiency under overload and the best economy of such a turbine is at the maximum load. It is to the advantage of users of this type of turbine to put on it all the load which the generator can carry without overheating. The General Electric Company has recognized this fact by establishing a maximum output by which the user will know the limits and by operating under those conditions get the most economical result. The rating of an engine is different in that it is necessary so to proportion the cylinders that maximum economy is obtained at some point not at the ultimate capacity of the engines. Considerable work is being done at the present time toward simplifying auxiliary apparatus, a matter of the utmost importance to the success of the steam turbine.

Mr. Thomas, of Baltimore, said that on occasions in his station, when reciprocating engines and turbines were driving generators operated in parallel, if any of the reciprocating engines dropped out, the generators driven by the turbines carried the major portion of the load. He thought it is very important that engineers should give greater protection to the mechanical strain on the coil supports and the coils. With a reciprocating engine generator this is not so necessary.

The Calibration of Portable Watt-Hour Meters.

By Chas. F. Hunter.

The usual method of checking the accuracy of a portable watt-hour meter, or "rotating standard," is by comparison with a wattmeter of known accuracy, the watts being computed from the reading of the rotating standard by the use of the formula:

$$w = \frac{r}{s} k$$

where

w = watts
r = revolutions of standard in time s
s = seconds as measured by stop watch

and

k = constant.

In the case of rotating standards designed for direct-current service, a voltmeter and an ammeter are usually used instead of a wattmeter as reference standards in order to avoid the necessity of taking reversed readings on the wattmeter.

A common procedure in making such a check is to connect up the rotating standard on any desired load, and let it run as a watt-hour meter.

The indicating instrument is also placed in circuit and a certain number of revolutions of the rotating standard are timed by a stop-watch, just as in the check of a house type watt-hour meter by indicating instruments. The time, revolutions and reading of rotating standard being known, the accuracy is computed from the formula given above.

Tests are generally made by holding the voltage as steady as possible, and taking a point at full load rating of each of the coils of the rotating standard, and also at points for each coil corresponding to the full-load point of the next lowest coil. Thus, for a 1-amp, 10-amp and 20-amp, 100-volt rotating standard, a test would be made at 1 amp on the 1-amp coil, at 1 and 10 amp on the 10-amp coil, and at 10 and 20 amp on the 20-amp coil. These tests show the accuracy of the instrument as affected by changes in load.

Tests also may and should be made by varying the voltage, power factor and frequency within operating limits, and noting the effect of this variation upon the accuracy of the rotating standard.

Two main difficulties present themselves in making checks by the above method: first, the rotating standard is not checked as used, and, second, a check cannot satisfactorily be made by one man, especially when the regulation of the circuit is unsteady. To overcome these objections there has been adopted recently a method of test which checks the standard as used and requires only one man. In making this test, the stop-watch is started and allowed to run continuously. The watch is laid on the test bench near the indicating instrument, so that one man may observe both closely. At a certain point on the watch dial, the tester starts the rotating standard by closing the push-button snap switch; at the end of a certain interval of time, say, 60 seconds, he stops the rotating standard. The accuracy of the instrument is then computed as before. The advantages of this method lie in the elimination of stop-watch troubles, in the increased ease of observation and computation, and in the checking of the rotating standard as used. On a perfect standard, the two methods should check very closely. However, a number of standards are found which "over-run," or in which the pointer continues to revolve after the circuit has been opened by the push button. It is stated that this over-running is compensated for by the inertia of the moving element in starting; the second method of test takes this fact into consideration. Moreover, push-button errors, which would not enter at all in the first method, are checked by this method.

A comparatively long interval is generally used when testing house meters by rotating standards. The interval used when checking the standard should be the same as the interval in actual use, provided the regulation of the test circuit allows close reading of the indicating instrument. Should this not be the case, it should be noted that any error due to push-button trouble or over-running becomes proportionately less as the interval increases in length. Therefore, a meter which shows 2 per cent inaccuracy on a 60-second interval, may be, when used on a 5-minute interval, within a fraction of a per cent inaccurate.

A complete test by both methods is often desirable, as demonstrating the errors introduced by the push-button and by the inertia of the moving element.

Advantages in the Use of High-Tension Underground Cables.

By Henry Floy.

In American cities and towns of any considerable size the local regulations require that all wires be put under ground, except in the more sparsely populated portions. Where such requirements exist, the distribution of electrical energy is at present being generally done by means of lead-covered cables threaded through vitrified clay, wood fiber or bituminized paper ducts laid in Portland cement. By far the greater proportion of work installed under the conditions cited is for low-potential distribution, although in the larger cities and as a section of a transmission line entering such a city district or passing under a river, many high-tension underground installations can be shown. The relative advantages of high-tension underground or aerial constructions cannot be properly considered in such connection, however, because sub-surface construction is more or less compulsory. It has, moreover, rather been the practice of engineers not to resort to the use of high-tension underground construction, except under some such compulsory conditions. As the advantages and reliability of high-tension cable construction are realized, a wider use of such cables is sure to result.

Among the advantages are:

First: Absolute freedom from interruption of service and damage to apparatus from lightning disturbances. It is generally recognized and acknowledged that any system of electrical distribution which is completely underground is immune from atmospheric lightning, although, of course, disturbances and undue potentials that arise by reason of surges, arcing grounds, etc., may occur with underground as with aerial systems.

Second: Less liability of interruption of service from breakdowns. "In New York where probably there is more cable than any other city in the United States, or in the world, interruptions of service due to the breaking down of a cable are almost unheard of."[1] Most of the breakdowns occurring in high-tension cables are the result of "human frailty," which can be largely anticipated and avoided. "As a rule, more trouble will develop on underground cables due to poor work on installation rather than to faults in the cables themselves."[2] To indicate the perfection of workmanship and material which may be attained by due care, it is said with regard to the method of making cable joints employed by the Commonwealth Edison Company, of Chicago, that "the method has been tried for six years on an installation comprising 420 miles of high-tension cable. During the entire term of this test only one failure of a cable joint occurred on these lines, and this was plainly attributable to external causes."[3]

On account of the increased cost of cables with high factors of safety, there is a strong tendency to reduce the thickness of insulation and thereby the cost, but at an increased risk of breakdowns.

For further statistics as to the freedom from interruption in the operation of cable reference may be had to an article by the writer in the Electrical World, Sept. 26, 1908.

Third: Fewer interruptions of service from extraneous inter-

[1] C. W. Rice, *Transactions*, A. I. E. E., Vol. XXIV, Page 416.
[2] I. A. Ferguson, "Underground Electrical Construction," *Transactions*, International Electrical Congress of St. Louis, 1904.
[3] Electrical World, page 544, Sept. 5, 1908.

ference. Short-circuits and grounds are more or less continually occurring with aerial lines due to breaking of mechanically weak wires or insulators, storms of wind or ice, objects falling across the wires and short-circuiting them, and malicious interference. With underground conductors, annoyances of the above character are almost entirely done away with, the cables usually being installed in ducts of tough material, enclosed in concrete several inches thick, the whole being from 1½ ft. to 3 ft. below the surface of the ground, except at manholes, which are protected by double, heavy iron covers, affording protection against almost anything but dynamite. In case of strikes it would be much easier to patrol and protect lines in conduits than those carried on poles, because the latter can be damaged from a distance by rifle shots or wires thrown over the lines; whereas, underground construction must be directly approached before it can be injured. It must be admitted that a breakdown in a cable is more serious than in an aerial line, because the latter can be repaired more quickly and with cheaper labor than the former; but breakdowns in cable systems are not nearly as frequent as interruptions of service with aerial lines, despite the fact that many high-tension cables are now operating with rather light insulation for the service.

Fourth: The liability of accident to the public with the consequent damage suits is almost entirely removed. The only likelihood of danger is from explosions of gas that may accumulate in ducts or manholes, but with proper design and construction this danger can be practically eliminated. Frequent injury or death to individuals coming in contact with broken aerial conductors are too much of an everyday occurrence to need any argument to prove the desirability of underground construction from the standpoint of safety of the public, regardless of esthetic considerations or the inconvenience of poles in streets.

Fifth: The danger to employees is less with underground than aerial construction for the reason that in repairing or stringing new aerial lines there are usually other live circuits on the same pole with which the workmen may come in contact, whereas with underground construction, the live cables are enclosed in lead sheaths and are, therefore, harmless.

Sixth: Breakdowns in aerial circuits usually occur without any forewarning. In contradistinction to this the weakening of the insulation of cables is often determined by tests or suitably designed indicating instruments, sufficiently in advance of the actual breaking down of the insulation to allow transferring to another cable without interruption of the service. There has been developed by Messrs. Torchio and Varley, of New York, a device now in commercial use which takes into account the unbalancing of the condenser capacity current when the insulation of a conductor begins to depreciate and gives warning of approaching danger sufficiently in advance of a breakdown to allow the cable to be disconnected.

In view of such considerations as the above, the writer has been seriously considering suggesting the installation of underground cables for the transmission of 20,000 hp, 15 miles across country, from a certain hydro-electric station to a substation in a neighboring city. By the use of conduits laid in the highways, the cost of expensive rights-of-way, real estate, building and lowering transformers for a substation at the outskirts of the city and liability of interference with the circuits will be avoided. While the increased cost of the underground construction seems large compared with aerial lines, the difference will be only a small percentage of the total cost of the complete system, as noted in the above table.

COMPARATIVE COSTS OF SYSTEMS.

Aerial Lines.		Underground Lines.	
Private right of way across country	$45,000	Eighteen miles of 4-duct conduit, at $5,000 a mile	$90,000
Steel towers with three circuits, complete for 15 miles	85,000	Three 25,000-volt paper cables (1 spare), at $1.50 per foot	428,000
Three miles of 8-duct conduit, at $7,000 per mile	21,000		
Six 10,000-volt paper cables (1 spare), at $1.10 per ft.	105,000		
Substation complete, with 18,000-kw transformer	95,000		
	$351,000		$518,000

Overhead Catenary Construction.

The committee on power distribution in its report to the American Street & Interurban Railway Engineering Association presented at Atlantic City on Oct. 14, embodies some valuable data on overhead catenary construction, to which subject special attention was given. The committee states that the majority of companies reporting show the use of No. 0000 grooved trolley wire for catenary work, which size and shape the committee recommends. There has recently been adopted by the manufacturers of wire a standard section known as the "American Standard." After sufficient experience shall have been had with this section, it should either be adopted or modified by the proper committee, and passed upon by the association for use as a standard.

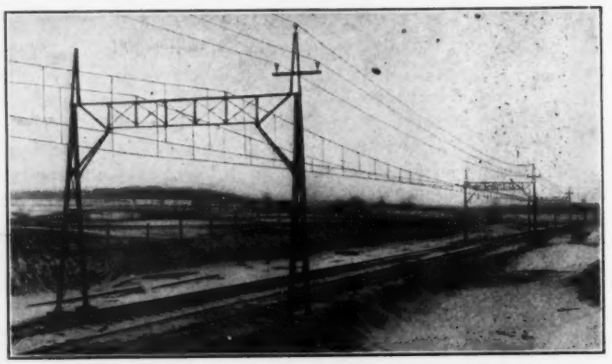


FIG. 1.—CATENARY CONSTRUCTION FOR INTERURBAN SERVICE.

All companies show the use of the mechanical clip and there seems to be no doubt but that this will continue to be modern practice. A rigid form of suspender is recommended by the committee. The question as to whether the suspender should clamp the catenary is still an open one. In this connection attention is called to the method adopted in Europe, noted further on in this article, which the committee thought a step in the right direction. The present practice in suspender spacing varies from 10 ft. to 46 ft.

Among the lines installed there is a wide divergence in sizes and quality of cable used. The committee recommends the use of the highest strength cable that can be obtained, in order to develop the full advantage of the catenary type of construction. The cable should be double galvanized and the committee submits the following specifications for galvanizing:

The galvanizing on the wires composing the cable shall consist of a coating of zinc, evenly and uniformly applied. The zinc shall be so applied that it will adhere firmly to the surface of the steel wires. The galvanizing shall be capable of the following test: The sample shall be immersed in a standard solution of copper sulphate for one minute and then removed, immediately washed in water thoroughly and wiped dry. This process shall be repeated. If, after the fourth immersion, there should be a copper-colored deposit on the sample, or the zinc should have been removed, the lot from which the sample was taken shall be rejected. The standard solution of copper sulphate shall consist of a solution of commercial copper sulphate crystals in water. This solution shall have a specific gravity of 1.185 at 70 deg. Fahr. While a sample is being tested the temperature of the standard solution at no time shall be less than 60 deg. Fahr., nor more than 80 deg. Fahr.

The subject of insulating supports for the messenger cable on high-tension service resolves itself into the use of porcelain entirely; the shape of insulators depending largely upon the voltage used. Strain insulators for heavy strains should also be made of porcelain. For steady strains and pull-offs the use of wood is permissible where moderate voltages are used, and a combination of wood and porcelain for higher voltages.

The more recent developments in supporting devices for catenary work indicate the use of structural steel bridges rather

than poles, thus deriving the full benefit of the catenary type of construction in the matter of long spans. Figs. 1 and 2 show the two extremes in this type of construction. The lighter type, Fig. 1, is used on ordinary electric interurban service, while the heavier type, Fig. 2, is used on an electrified steam road using electric locomotive haulage.

The opinion of the committee is that a bridge form of construction should receive very careful consideration at the hands of companies contemplating the installation of catenary before final decision is reached on the type of supports to be used. This is made an especially important consideration in view of the recent experience in high maintenance costs, due to excessive deterioration of wood pole lines.

A paper on the application of the theory of the catenary to electric railway work by Mr. R. L. Allen formed part of the report. Mr. Allen gave some interesting details of construction and also a graphic solution for determining the sag in the messenger cable before the weight of the trolley and hangers is put on, based upon methods suggested by Mr. H. W. Buck, of the Niagara Falls Power Company, and also by Dr. Harold Pender, in ELECTRICAL WORLD (Jan. 12, 1907). He gives some observations taken from a catenary trolley of 300-ft. span as regards the raising of the contact wire.

The net sag of the messenger cable in winter was 5 ft. 8 in., the contact wire being cambered 10 in. at the center, and was very tight; the hangers were spaced 10 ft. apart. A scale was applied to the trolley at 5-ft. intervals along the span and lifted until it registered 25 lb. The net rise of the trolley was then measured. This increased gradually from ½ in. under the bridges to 2¾ in. at the center of the span. It may be noted that there was practically no difference between the stiffness of the trolley at the hangers and at a point midway between them.

The change in length of copper due to changes in temperature is one of the greatest difficulties in the maintenance of overhead work. A drop of 100 deg. in temperature will cause a copper bar to contract approximately 1 in. for every 100 ft. of length. If it be restrained at the ends this will mean an additional stress of 2500 lb. in a No. 0000 trolley. In span-wire

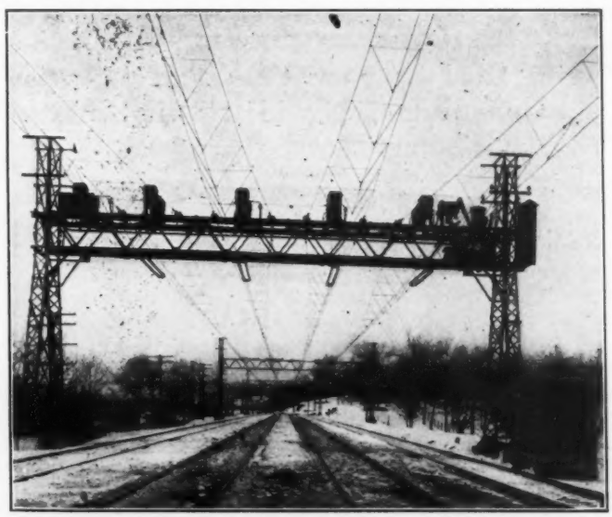


FIG. 2.—CATENARY CONSTRUCTION FOR ELECTRIC LOCOMOTIVE HAULAGE.

construction this is partially taken care of by the variation in sag of the trolley line. In catenary construction where the trolley is supported at short intervals there is no chance for the trolley to take up the slack by sagging, consequently it is liable to become very slack in warm weather. For this reason Mr. Allen believes that unless there is some counterweight devised for maintaining a constant tension on the trolley, the hangers should be spaced not closer than 20 ft. A system has been developed on the Continent consisting of a single catenary with an auxiliary messenger which is parallel with the trolley and about 3 in. or 4 in. above it. This secondary messenger is hung at intervals of about 30 ft. by hangers from the supporting cable, and supports the contact wire by sliding clips located about 10 ft. on centers. The trolley wire is kept at a constant tension by counterweights located at long intervals. This construction also provides a practically uniform cushioning effect, as the trolley clips are very light and slide up and down on the secondary messenger. It remains to be seen whether this complication is necessary and whether practically the same results cannot be obtained by a development of the single catenary system on the lines suggested above, as follows: (*a*) The use of a light plow steel messenger cable strung to a small sag. This will allow full advantage of the elasticity of the material. (*b*) The hangers themselves should be as light and flexible as is consistent with strength and durability. This will tend to prevent sparking at the points of support. (*c*) The hanger should be spaced 20 ft. or 30 ft. apart to take care of the expansion and contraction. (*d*) There is no reason why spans of 300 ft. or more cannot be used.

In a written discussion to this subject Mr. R. D. Coombs, structural engineer of the Pennsylvania Tunnel & Terminal Company, said no system can be a success which does not practically eliminate sparking and undue wear of the current collector, whether that collector is a trolley wheel or a pantograph. To obtain this end various designs of catenary construction have been evolved, and are being tested on the Long Island Railroad.

Of the two types in general favor, i. e., the "single catenary," and what the writer has called the "secondary catenary," there exists in this country a number of installations of the former, but none of the latter type. The single catenary, having the trolley wires suspended from one messenger, is familiar to all. The secondary catenary, which has been described by Mr. Allen, is intended to provide an elastic track for the collector and at the same time to remove the excessive tension in the trolley wire, due to changes in temperature. At present no definite decision can be made as to which of these types is better suited for Eastern climatic conditions and American operating requirements. The successful type must accommodate itself to changes in temperature, and provide a trolley wire on which the collector may run smoothly.

From an operating standpoint, the construction should not involve unnecessary supports over the tracks, and long spans are therefore desirable. The writer is of the opinion that spans in excess of 300 ft. will be both economical and practicable. Owing to the relatively small cost of the material between supports, theoretical considerations alone would point to much longer spans. To what extent this increase may be made is rather uncertain, though long spans have a decided advantage in not multiplying the number of structures along the right of way. These structures should be designed to avoid unnecessary masses of materials over the tracks or in line with signals. The design of details should be given great attention, so as to evolve connections that permit rapid field work and require a minimum of maintenance.

Incandescent Lamps.

At the recent Electrical Exhibition held in Manchester, England, there were many metallic filament exhibits, especially of tantalum lamps and tungsten lamps. A new tungsten lamp is the "Sunbeam," which is made for pressures from 25 to 250 volts. The specific consumption is stated by the makers to be 1.25 watts per candle-power. The makers claim practical immunity from breakage during transit, owing to the form of the filament and the shortness of the bulb. The Serius-Efesca is another new metallic-filament lamp. The feature of the lamp is a special method of supporting the filament by means of small central forks, which tend to press it slightly out of the vertical and render it comparatively free from risk of breakage due to vibration. The splaying of the filament also assists in the downward distribution of the light.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Progress with Heating Appliances at Denver.

The Denver Gas & Electric Company has been steadily at work the past year introducing small electric heating appliances among its electric customers. About 3000 irons were introduced the first year the company began pushing them, and about 3000 more have been placed the past year. Next after flatirons, the most popular devices are small stoves, coffee percolators, chafing dishes and toasters. These appliances are placed among customers by service supervisors, whose sole duty is to introduce new appliances and secure additional revenue from customers already taking service.

Tungsten Lamp Policy, Houghton County, Mich.

The Houghton County Electric Light Company, which is one of the Stone & Webster properties supplying electric light and power service to Houghton, Hancock, Calumet, Lake Linden and other towns in the Lake Superior copper country, has the following policy regarding tungsten lamps: The company handles the 100-watt size of lamp and reflector, leaving the local contractors to handle 60- and 40-watt sizes. The company will rent a 100-watt tungsten lamp and reflector for 40 cents per lamp per month. This includes lamp renewals, but of course does not include electrical energy used. Or the company will sell the lamp and reflector for $3, the consumer to furnish renewals. Consumers must agree not to touch the lamps which are rented. The company does all the handling, renewals and cleaning. Experience shows that about half the consumers using tungsten lamps take the rental proposition and the other half buy the lamps outright.

"Stop-Loss" Illumination Design.

By Jas. R. Long.

While much has been said in central-station circles about introducing the tungsten lamp in such a way as to secure increased illumination for consumers rather than reducing their consumption for the same illumination, there is another aspect of the tungsten lamp situation which comes up frequently when central-station companies are called upon to plan illuminating equipment for consumers. I refer especially to lighting installations of exceedingly poor load factor—those where the maximum demand for current is enormous and the number of hours' use of the installation per year is very small. Many instances arise where it is largely a problem of giving satisfactory illumination with a minimum demand for current. It is practically certain in these cases that the central-station company will lose money in supplying the installation because of the small yearly revenue and the large generating and distributing capacity investment needed to supply it. On the other hand, the company cannot turn away such customers, nor afford to have the lighting insufficient and unsatisfactory, as that would be a poor advertisement for central-station service. It therefore becomes a problem of designing the illumination so as to cause the least annual loss to the central-station company. Buildings of the auditorium or coliseum character are likely to require light but a few hours per year. The same is true of some other large public buildings. In one case special illumination was asked for in a library where such special illumination would probably be used only on Saturday nights during the winter. In all such cases the central-station company's best interests will be served by putting in lamps of very high efficiency; and since the investment inside the building is borne by the consumer, the question of first cost of the installation does not concern the company. In a recent case either flaming arcs or tungsten lamps could have been installed at about the same price for a given amount of useful illumination. The flaming arc, however, was the best for the central-station company, because there was certain to be an annual loss in serving the building, because of the fact that the actual revenue from the sale of electrical energy would be nowhere equal to the interest and depreciation charges on the apparatus necessary to serve it.

Experience with Tungsten Lamps.

At the annual convention of the Arkansas Association of Public Utility Operators, held at Little Rock, Sept. 17 and 18, Mr. T. R. Phillips presented a paper entitled, "Advantages and Disadvantages of Tungsten Lamps to Central Stations," which reported the experience of the Little Rock Railway & Electric Company with these illuminants. Among the advantages mentioned were the following: New business obtainable by reason of the reduced cost; better satisfied customers who obtain the former illumination for less cost or greater illumination at the same cost. He cited the case of a jewelry store, the lighting of which with arc lamps and carbon filament lamps cost $28 per month. When tungsten lamps were substituted the cost was reduced to $15 per month. It might seem that the company had lost $13 by the change, but the fact is that it retained a customer who had become disgusted with the high cost of the old service and transformed him into a thoroughly satisfied customer and a good advocate for the central station. Mr. Phillips expressed the opinion that, although the tungsten lamps possess the disadvantages of requiring extreme care in handling, are liable to burn out in a few days after being installed, and are too costly to be furnished on a free-renewal basis, yet in the near future these lamps will predominate in the lighting industry.

Forms Used by New York Public Service Commission, Second District, in Testing Electric Meters.

The Division of Light, Heat and Power of the New York Public Service Commission, Second District, has cognizance of the testing of meters concerning which complaints have been made, and of the inspection of standard meters. This division, of which Mr. Henry C. Hazzard is chief, also keeps permanent records of complaints from consumers regarding electric meters. A permanent record is also kept of inspections of meters, and a form is provided for the results of tests by the companies of consumers' electric meters.

Section 67 of the Public Service Commission's law states: "If any consumer to whom a meter has been furnished shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested; if the same on being so tested shall be found to be 4 per cent, if an electric meter, and 2 per cent, if a gas meter, defective or incorrect to the prejudice of the consumer, the inspector shall order the gas or electric corporation to forthwith remove the same and to place instead thereof a correct meter, and the expense of such inspection and test shall be borne by the corporation; if the same on being so tested shall be found to be correct, the expense of such inspection and test shall be borne by the consumer. A uniform reasonable charge shall be fixed by the commission for this service."

Under the authority conferred in this section of the law, the commission has fixed charges which are applied uniformly. These charges correspond in part to the similar charges pre-

scribed by the Public Service Commission of the First District of New York, which were published in the ELECTRICAL WORLD of Aug. 15, 1908, page 333. The charges prescribed by the Second District Commission are as follows:

1. For direct current two- or three-wire watt-hour meters and single-phase alternating-current watt-hour meters operating on constant potential circuits of 600 volts and less:

Rated amperes.	Fee.
5 and under	$1.00
Over 5 to 10	1.50
Over 10 to 15	2.00
Over 15 to 25	2.50
Over 25 to 50	3.00

For each additional 10 amp or fractions thereof, 50 cents.

2. For polyphase meters and meters operating on circuits of over 600 volts:

Rating kilowatts.	Fee.
Less than 25	$.300
25 and under 100	6.00
100 and under 500	15.00
500 and over	30.00

If a test is required on any meter not included in either of the above classifications, the commission will establish the fee therefor on application.

A consumer may obtain on request the form of the commission asking an inspection of the electric meter measuring energy supplied to him. This request when sent in must be accompanied by the amount of the fee. The request for inspection must also give the name of company, type and maker's

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION—SECOND DISTRICT.

DIVISION OF LIGHT, HEAT AND POWER.

Central and Sub-station Record.

Place ..... Date 190
Company .....
Main Plant .....
R. R. Sta. ..... Dist. .....
Sub-stations: .....
.....
.....
Territory covered .....
Generators, type and size .....
.....
.....
Cycles ..... 1, 2 or 3 phase .....
Voltage, lighting ..... power .....
Storage Batt. ..... Voltage Regulators .....
Regulation ..... Power Factor .....
Station Meters .....
.....
Portable Meters .....
.....
House Meters .....
.....
Separate Seal Meters ..... Prepayment .....
Large Power Installations .....
.....
.....
Remarks on Meter Dept. .....
No. Men Employed .....
Equipment .....
.....
Meters Calibrated When ..... Where .....
Charge .....

FIG. 1.—FORM OF CENTRAL STATION AND SUBSTATION RECORDS.

number of meter, amperes (rating) of meter, rated voltage of meter, and frequency (if alternating-current meter).

A receipt for the fee is sent to the consumer. The chief of the division, on receiving a complaint of this character, sends notice to one of the inspectors of the commission to inspect the meter. The inspector is directed to give at least 24 hours' notice to the complainant of the date and hour of the test and to notify the operating company in time for it to send a representative to be present at the test. After receiving this notice from the chief of the division, the inspector notifies the complainant by postal card of the time when he will call for the purpose of testing the electric meter. The inspector's form of report is shown in Fig. 4.

If the meter is found to be within the limits provided by

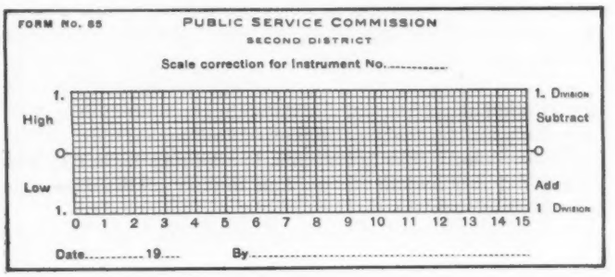


FIG. 2.—SCALE CORRECTION FORM.

law, the inspector states that fact on a complaint inspection tag which he affixes to the meter. The tag bears his signature and the name of the Public Service Commission, Second District, of the State of New York. This tag shows the maker and type of the meter and gives data concerning the amperes, volts, manufacturer's serial number, company number and the name of the owner.

If the meter is found inaccurate, it is either readjusted at once and again tested by the inspector of the commission, or is removed and replaced with a correct meter.

In all cases notice is sent to the company of the result of the test. A copy of the inspector's report as approved by the commission is enclosed for the information of the company in such instances. The form of the letter of notification used in cases of this character shows the maximum percentage registration and the percentage fast or slow at the different test points, indicating that the meter was correct or incorrect within the meaning of the law. A similar letter is sent to the consumer

FORM No. 61 THIS FORM TO BE USED IN CHECKING INDICATING INSTRUMENTS

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION
SECOND DISTRICT

Serial No.
Name of Company Date 190
Meter Tested: Type and Maker M'f'r's No
Size, Amp. Volts Watts Frequency
Test Circuit

METER			STANDARD			P F	% Acc
VOLTS	AMP.	WATTS	VOLTS	AMP.	WATTS		

Standards Nos.
Approved Checked
Remarks:

FIG. 3.—FORM FOR CHECKING METERS.

which contains the additional note that if the test shows the meter to be 4 per cent or more fast, a certificate will be enclosed which, presented to the company, will entitle the complainant to receive from the company the amount of his fee. The certificate is printed on safety paper, is signed for the commission by its secretary, and reads as follows:

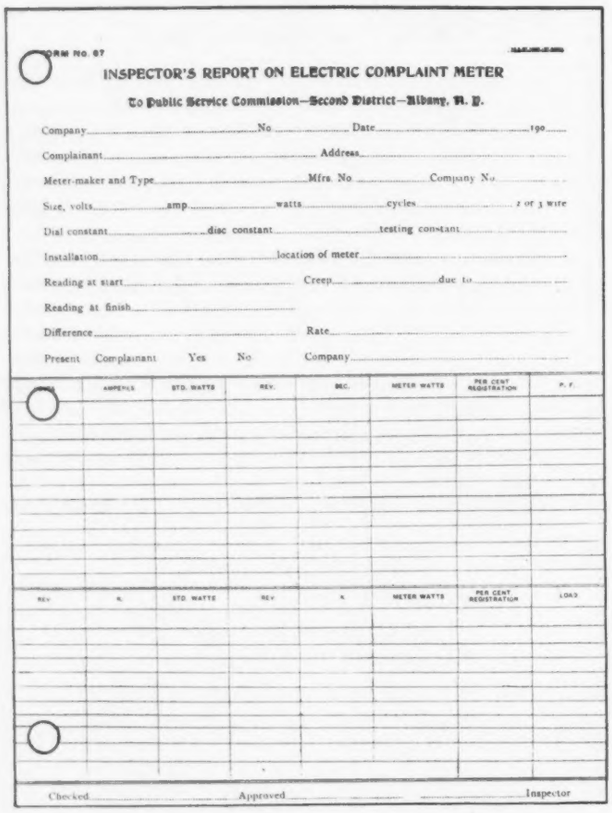
"This certifies that ....., a consumer to whom .....

meter has been furnished by your company, having paid this commission a fee of ..... dollars ..... cents for the test of said meter on his premises, ..., and the same having been inspected and tested and found incorrect to the prejudice of said consumer, he is entitled to have the amount of said fee refunded to him by your company."

A form is provided for use in checking indicating instruments used by the companies as testing apparatus. The general information on this form is similar to that on forms used for other purposes, and Fig. 3 shows the character of the detail information which is obtained.

A form for use in checking rotating standards provides for information similar to that contained in the form of inspector's report on electric complaint meters, to which reference is made in the foregoing. The form used in checking such standards, however, has a column for constant in place of that shown for standard watts in the illustration.

If a standard of any company is inspected and found to


FORM No. 87

INSPECTOR'S REPORT ON ELECTRIC COMPLAINT METER

To Public Service Commission—Second District—Albany, N. Y.

Company..... No..... Date..... 190...

Complainant..... Address.....

Meter-maker and Type..... Mfrs. No..... Company No.....

Size, volts..... amp..... watts..... cycles..... 2 or 3 wire

Dial constant..... disc constant..... testing constant.....

Installation..... location of meter.....

Reading at start..... Creep..... due to.....

Reading at finish.....

Difference..... Rate.....

Present Complainant Yes No Company.....

	AMPERES	STD. WATTS	REV.	DEC.	METER WATTS	PER CENT REGISTRATION	P. F.

REV.	K	STD. WATTS	REV.	K	METER WATTS	PER CENT REGISTRATION	LOAD

Checked..... Approved..... Inspector

FIG. 4.—FORM OF INSPECTOR'S REPORT.

register correctly, it is approved for the commission by a formal certificate signed by the secretary.

The scope of the information desired in the central and substation record is indicated by Fig. 1.

The weekly report of electrical standard meter inspection provides for information covering the following: Voltmeters, ammeters, indicating wattmeters, rotating standard, stop watches, certificates of inspection and approval issued, requiring readjustment or recalibration, type not approved, apparatus satisfactory, testing apparatus recommended, total meters inspected.

The scale correction form for instruments is illustrated herewith.

The special form for a monthly report by the companies to the commission concerning the inspection of consumers' electric meters has columns headed as follows: Maker and type, manufacturer's number, rating, volts and amperes; percentage registration, light load 5 per cent or 10 per cent, normal load and full load; place of test; date of last test; reason for test.

Development of an Alternating-Current Distributing System.

Mr. H. B. Gear, of the Commonwealth Edison Company, Chicago, presented a comprehensive paper on the above subject before the Western Society of Engineers on Oct. 16.

This paper included a discussion of some of the problems which are common to the development of every distributing system, as well as others which are encountered only in special cases. Mr. Gear said in part:

The energy supplied to an outlying or suburban district must necessarily be given through the medium of alternating current on account of the scattered nature of the users. This necessity involves three principal elements: primary feeders and distributing mains, transformers, and secondary distributing mains.

Each transformer is essentially a small substation which receives electricity at approximately 2200 volts and delivers it at approximately 110 or 220 volts. The distribution of electricty from this miniature substation must, therefore, conform to the laws governing the distribution at low voltage. The low voltage means a comparatively heavy cross-section of copper and short lengths of circuit.

The growth of a distributing system consists for the most part of a number of small and scattered increments of load which affect the secondary system and the transformer before they affect the primary system. He, therefore, considered these questions in the reverse order from the flow of electricity, but in the logical order of reinforcement of the physical plant.

SECONDARY DISTRIBUTION.

A system of secondary mains passes through three general stages of development in expanding from a small to a large system.

1. A period in which scattered transformers supply energy to isolated secondary mains not interconnected with other transformers.

2. A period in which the mains from adjacent transformers increase together along principal thoroughfares where they may be connected to each other, but intersecting few other secondary mains of importance.

3. A final stage in which secondary mains are required on nearly all streets and are, therefore, joined into a network.

The first period is that found in residence and other outlying territory not fully built up. When a new consumer is to be connected in such a territory the problem is: Shall a transformer be installed or the nearest secondary main be extended to the premises? The installation of a transformer involves an investment and an operating expense, due to its core loss. The extension of the secondary main also involves an investment in conductors and perhaps an increase in the capacity of an existing transformer. The cost of the two alternative plans being ascertained, the one selected should be that which involves the least annual cost for interest, depreciation and operation.

There is little occasion in this period of development to connect secondary mains in multiple. Where the mains have been extended until they meet each other it is usually preferable not to connect them, as the blowing of the fuse of either transformer shifts the load to the other and overloading it blows its fuse also; and transformers are so far apart that they cannot share each other's load to any appreciable extent in case of an overload on either of them.

The second period of development is reached when consumers become so closely situated that it is necessary to provide a secondary main along the entire length of a thoroughfare. This condition is usually first met along business streets and boulevards, and results in a long secondary main receiving energy at intervals from transformers, but intersected by few other secondary mains of importance. When such a main has been established it is the problem of the engineer to determine how far apart transformers should be located and what size of conductor should be used.

The density of the load varies in different parts of the street

and there are large blocks of load at particular points which make the problem a perplexing one at best.

Calculations made on the assumption of an evenly distributed load on a straight secondary main 1000 ft. long, with transformers and wire figured at average costs of the past few years, indicate that where the load is heavy enough to derive any benefit from either connection the most economical arrangement of transformers occurs on overhead lines with a spacing of about 500 ft. when the drop on the secondary main averages 2 per cent from the transformer to the most remote customer's service.

With underground lines the most economical spacing is between 300 ft. and 400 ft.

It is necessary in practice to locate transformers as closely as possible to large consumers' premises and design the main between them to carry the load of scattered consumers which is approximately evenly distributed. An extended secondary main may therefore be made up of several sizes of wire at different points with transformers having various spacings, depending upon the load density in the vicinity.

SECONDARIES FOR MOTOR LOAD.

Where both motor and lamp service must be given in the same locality, provision must usually be made for separate transformers and secondary mains for motor service on account of the poor regulation of transformers carrying inductive loads which produces flickering and insufficient light when the motors are connected to the same transformers with the lamps.

Secondary mains for motors may be designed with as much as 5 per cent drop, however, and may therefore be extended somewhat further from transformers than lighting secondaries.

In manufacturing districts the motor load exceeds the lamp load, but is usually so much scattered that no secondary mains of great extent are developed.

In mercantile districts of medium-sized cities where there is a fairly heavy load of both lamps and motors, it is often a serious question to determine the best methods of giving service with a minimum investment in conductors. Where the motor load is less than 50 per cent of the total and where the transformer rating is so great that the starting current of individual motors is not noticeable, it is permissible to combine lamp and motor secondaries in one system.

SIZE OF TRANSFORMERS.

The selection of the proper size transformer for the supply of energy to various classes of consumers is a matter of great importance since excess equipment involves idle investment as well as unnecessary core losses. The size of transformer units should therefore be kept as low as possible consistent with heating of the apparatus and good regulation.

Certain ratios of maximum demand to connected load may be established by a series of such measurements for the various classes of consumers for which it is necessary to select transformers. These ratios may then be applied with reasonable certainty to the selection of transformers for new consumers.

For instance, it has been found in the city of Chicago that in store lighting the maximum demand for window lighting, signs and other display lighting is practically 100 per cent of the connected load. The demand on interior store lighting is from 75 to 80 per cent. There are usually two or three nights in the week in which the demand will be less than this. In residences where the connected load is 50 lamps or more, the average maximum demand of a group of residences is from 15 to 20 per cent of the connected load. Individual residences may have occasional maximums of from 30 to 50 per cent for which some allowance should be made in selecting transformer ratings. The size of the transformer should be such that it will carry the occasional high maximum of the largest individual consumer together with the average maximum of the other consumers on the transformer. Oil transformers may safely be permitted to carry from 25 to 50 per cent overload occasionally in such cases.

Small residences and apartments having connected loads of 40 lamps or under, average about 20 per cent of the connected load, with from 25 to 30 per cent as an occasional maximum.

In general, a higher ratio must be used where only two or three customers receive energy from a single transformer than where there are 10 or more consumers, as the occasional maximum of individual consumers is a much larger percentage of the total.

In the case of churches and similar public buildings equipment must be provided for the illumination of the largest room in the building, together with the necessary hallways and corridors. This usually requires rating for at least 75 per cent of the connected load.

In theater lighting, allowance may be made for the use of border and foot lamps of several colors which are not used simultaneously and for the fact that the stage and auditorium are not lighted simultaneously except for a very few minutes at a time. In a small theater the ratio may be from 70 to 85 per cent, while in a large theater it frequently runs as low as 50 per cent.

Where several classes of buildings receive energy from one transformer, the rating must, of course, be determined by taking each class into consideration separately and thus arriving at an average ratio for the whole.

The selection of transformers for motor users is a more difficult task, as the maximum load may vary greatly from day to day or from month to month. Consumers having only one or two motors generally require from 60 to 90 per cent of the aggregate horse-power of their machines. The connected load should be estimated where possible from the nature of the work done rather than from the motor ratings, as motors are frequently chosen with reserve capacity. Where there is a considerable number of motors the maximum load is often not more than 50 per cent of the aggregate rated horse-power of the motors. Elevator and crane motors require transformers of from 100 to 125 per cent of their rating unless several motors receive energy from one unit. This is necessary in order to hold up the pressure in starting. The load of such equipments is so intermittent that heating is usually not a factor in determining the size of the transformer.

The type of transformer which has proved most adaptable to conditions of outdoor service is the oil-cooled core type with a weather-proof case. The core type has proved to be the easiest to insulate to a high degree and has external dimensions which are well adapted to location on poles or in manholes.

Improvements in recent years have resulted in a considerable reduction of iron losses, but there is some doubt as to whether the recent tendency to make a saving in the weight of copper required by increasing the exciting current is one which should be encouraged. A design which requires an exciting current of from 15 to 20 per cent of the normal full-load current of the transformer at a power factor of about 20 per cent if carried out through a large system would require the operation of extra generating equipment during the light-load period to supply the wattless current.

SYSTEMS OF DISTRIBUTION.

The three-phase system is perhaps most generally employed for primary distribution. This is accomplished by two methods, commonly known as the three-wire and the four-wire.

In the three-wire three-phase system the voltage between phase wires is approximately 2200 and transformers are connected from line to line. Lighting lines are operated from one phase of the three-wire line. Where energy is to be delivered to three-phase motors three wires must be run and either two or three transformers installed. Two transformers with secondaries connected on the open-delta plan are usually found satisfactory for motors whose ratings do not exceed 25 hp. The advantage of this method is the reduced cost of transformers, iron losses and expense of installation. The unbalance caused by such a connection is not serious as it may be readily offset by single-phase taps connected to the other phase.

In sections of cities where the load is principally lighting, but where three-phase motors are required for occasional elevators

and similar equipment, it is usual to connect all the lamps to one phase, two of the wires being made of proper size for this purpose. A third wire of No. 6 or No. 4 is run into the district to supply energy to such motors as it may be necessary to serve.

This plan has the advantage that a regulator may be installed in one-phase wire and accurate regulation provided on the lighting phase. Where lamps are connected on all phases it is necessary to install regulators in each phase wire with the result that the operation of either regulator affects the pressure on the two phases and renders the work of pressure regulation too cumbersome.

For a large system where the number of feeders must be kept down to a minimum and where they must be loaded to the best advantage, this system, therefore, has serious limitations. For such situations the four-wire three-phase system has decided advantages over the three-wire system and has, therefore, been adopted in several of the larger cities, notably Chicago and Cincinnati.

The special advantage of this system is that where there is sufficient load to require a three-phase feeder, the transmission is effected at 3800 volts, and loads up to 500 kw may be distributed from a single feeder at distances of over three miles from the station with four wires, whose size is fixed only by their current-carrying capacity.

The neutral wire in this system naturally runs near earth potential and is, therefore, usually grounded at the generating station. This makes it necessary to look somewhat more carefully after the insulation of lighting arresters, cables at points where they join overhead wires, fuse boxes and other fittings, than in other systems. It is also necessary that linemen exercise more care in working on lines where two or more phase wires are present, since the difference of potential between wires is about 3800 volts instead of 2200. This system requires one-third the copper in feeders required for a single or two-phase system at 2200 volts, or 44.4 per cent of that required for a three-wire three-phase system at 2200 volts under equivalent conditions.

Standard 2200 volt transformers may be used for all purposes, being Y-connected for motor service and fed from a phase wire and neutral for lighting purposes.

In a section where there is mercantile lighting and manufacturing business the four-wire mains usually cover the principal thoroughfares in the section receiving energy from the feeder. This system also possesses certain advantages for transmission purposes where suburban sections are to be supplied with energy and where the extent of the load does not warrant the erection of an expensive substation. In such cases the erection of a four-wire line operated at double or triple the main distributing voltage, will double or triple the radius of supply and thus enable the load to be delivered at the remoter sections with no more than normal feeder line loss. The step-down transformers may be of the weather-proof type mounted on a suitable platform in the open and thus require no attendance or substation expense other than the investment in the transformer.

In the above manner a four-wire line may be used to supply energy to adjacent suburbs at minimum expense and yet give the suburbs as high class service as is given by the feeders operated directly from the main station. This result is possible because of the use of the fourth wire which takes care of the unbalanced load and which in conjunction with line-drop compensators and feeder regulators on each phase lead makes the matter of unbalanced load one of no consequence.

INTERIOR WIRING AND ILLUMINATION

Lighting of a Denver Street.

Some time ago Sixteenth Street, in Denver, was improved in appearance by the erection of special poles in place of the regular street-railway poles, on each of which an arc lamp was placed. The design of the Sixteenth Street pole was illustrated in these columns at the time. Recently Fifteenth Street, also an important thoroughfare in the retail district, has been lighted in the same manner, but with a different design of pole. The pole is shown herewith. Eight of these posts are distributed on a block, four on each side of the street, a block being 336 ft. long. The arc lamps are 6-amp, 110-volt, enclosed type, and are burned all night every night for $60 per year, energy being

LIGHTING OF A DENVER STREET.

furnished by the Denver Gas & Electric Company. The Denver Tramway Company furnished the poles and the city paid for the special ornamental bracket. The Denver Gas & Electric Company furnished the lamps and connections. This case is interesting as adding another precedent for the special lighting of downtown streets at the expense of the city rather than at the expense of merchants and property owners along the streets. The lighting extends for 15 blocks on Fifteenth Street, and, with eight lamps to the block, makes the total number of lamps in use 120. The lamps have opal outer globes. The brackets, which are of a design approved by the Municipal Art League, are of wrought iron and cost about $50 each, erected, exclusive of the poles.

The Lighting of a Large Outdoor Arena.

An interesting piece of outdoor arena lighting, probably one of the largest jobs of the kind ever undertaken, was carried out in September at St. Joseph, Mo., at the time of the United States military tournament and live stock show. The size of

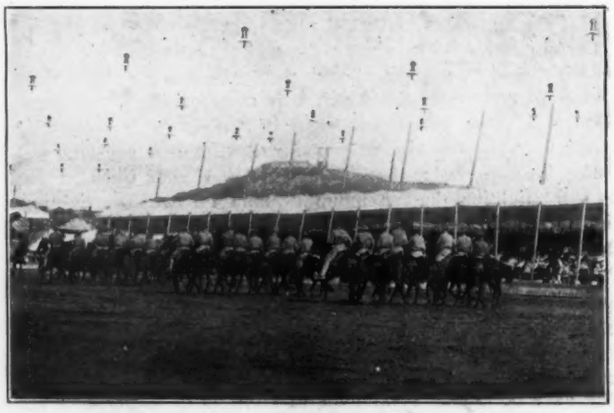


FIG. I.—LIGHTING A LARGE OUTDOOR ARENA.

this arena was 450 ft. x 227 ft., making a total area of 102,150 sq. ft. Figs. 1, 2 and 3 are views of the arena taken during the tournament and stock show. The space was illuminated by 127 General Electric 6-amp multiple alternating-current arc lamps on 110-volt circuits. The watts per square foot, assuming 62 per cent power factor for the lamp, would be 0.52. As

seen from the engravings, the lamps were suspended on span wires stretched across the arena, supported by poles placed entirely outside of the enclosure. Parallel with each span wire are the two wires which supply energy to the lamps. The span cable was 5/16 in. and was anchored at each end by 6-in. Mat-

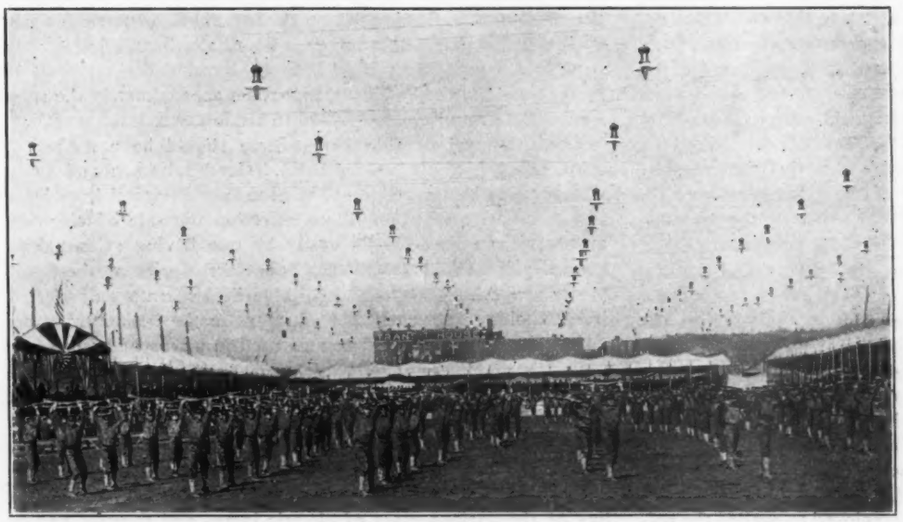


FIG. 2.—LIGHTING A LARGE OUTDOOR ARENA.

thews guy anchors. These span cables were placed parallel across the arena, with 22.5 ft. between spans. One span had six lamps, the next span seven, and so on, alternating, the length of the field. The work was done by the St. Joseph Railway, Light, Heat & Power Company. To fulfill this sudden demand for arc lamps, 75 lamps were borrowed from the central-station companies at Peoria and Springfield, Ill., which are controlled by the same syndicate. Mr. F. P. St. Clair, light and power superintendent, of the St. Joseph company, to whom we are indebted for this information, informs us that the illumination compared favorably with that common with indoor lighting, and that it was possible to distinguish faces from one side of the arena to the other.

Advertising Value of a Display and Sales Room.

An interesting paper based on the experiences of various Edison companies was read at the annual meeting of the Association of Edison Illuminating Companies at Lenox, Mass., by Messrs. Howard K. Mohr and Joseph D. Israel, the title of the paper being "Some Advertising Notes, with Particular Reference to the Advertising Value of a Display and Sales Room." In the opinion of the authors, central station advertising has outgrown its swaddling clothes and it is necessary for the advertising department to show that there is an actual money return for expenditures made to warrant the existence of such a department. It is necessary, therefore, for these departments to keep records of the replies received and the business secured owing to this means.

One of the larger companies gives a very easy method for keeping track of results obtained from direct-by-mail advertising which could be adopted by other companies doing advertising of this nature. The daily report blank of the solicitors contains a tear-off slip upon which the solicitor writes the name and address of those persons in his district not using electricity, or perhaps using both electricity and gas, or who might use electricity for motors, signs, etc. The contract department forwards these slips daily to the advertising department, and if the names are not already on the addressing list, the advertising department adds them. All written inquiries, whether upon the return post cards attached to advertising mail matter, or in the shape of letters referring to advertisements seen, or telephone messages of the same nature and, as far as possible, verbal inquiries received by the company, are first sent to the advertising department. The latter department keeps a card index system, and each day, as such inquiries are received, the names and addresses, and particular data given, are transcribed upon these cards. The inquiries are then promptly returned to the contract department for follow-up by a solicitor; the cards are placed in the proper files.

Each month the reports of new business secured are turned over to the advertising department, and advertising is credited with all contracts secured as the result of following up an inquiry received from advertising, as shown by the card index. The individual cards are then completed by noting the conditions of the contract upon the individual cards, including the lamps and horse-power connected, after which the card is removed from the regular files—the name is removed from the advertising list, and the card placed in the "finished business" file. At the end of the year the value of the business secured as the result of this advertising is estimated by multiplying the gross business secured, in kilowatts, by the average revenue per kilowatt connected during that year, or the value of the business secured may be determined in any other convenient manner.

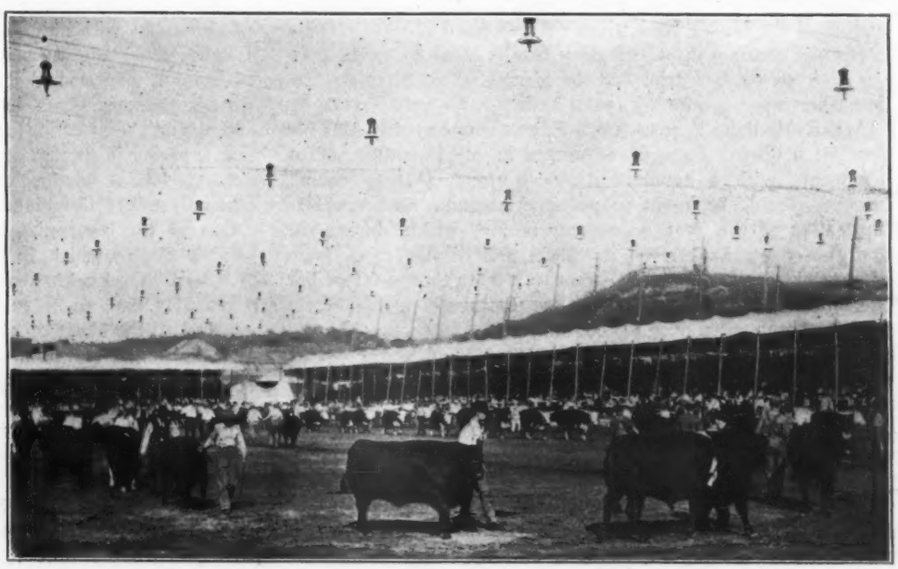


FIG. 3.—LIGHTING A LARGE OUTDOOR ARENA.

The direct results shown from the advertising done by one of the Edison companies, compiled from records kept as outlined, show for a period of three years, contracts closed for an equivalent of 70,000 16-cp lamps. The estimated yearly revenue from this connected load at the present time amounts to

$200,000, and the advertising for the three years was $38,000.

Records such as outlined are easily kept. but it is necessary for the mail matter to contain the reply feature. The latter is also of value in obtaining complaints and suggestions which are frequently of service in tracing or discovering faults or delinquencies of employees. As showing what amount is spent by companies for advertising, the authors state that two years ago advertising costs of the companies composing the association varied from one-quarter of one per cent to 2½ per cent of the gross revenue, the average expense of the larger companies which were doing the most systematic work along publicity lines being about 1¼ per cent. The answers to the same question asked this year show expenditures for advertising to vary from one-third of one per cent to about 3 per cent of the gross revenue. The larger companies, however, have reduced their yearly expenditure approximately 1 per cent of their gross revenue.

Analyzing the data furnished them, the authors find that for every 100 replies received from advertising, about 15 contracts are obtained by the follow-up of the solicitor. The replies also indicated that direct-by-mail advertising lost its effectiveness if the series continued over a period of two, three or four years. As between newspaper advertising and direct-by-mail advertising, it seems to be recognized that the most satisfactory results are obtained by judicious supplementing of one by the other. "Policy advertising" in the newspapers is now being done in a far more logical and less haphazard manner than heretofore. Newspaper space is frequently being employed to outline the policy of the company toward the public or to call attention to the advantages of the city as a manufacturing or residence center.

In answering the question which asked for a description of any particular advertising wrinkle, either by mail or in any other form which has brought quick and tangible results, the companies furnish very little information that is new. One company says: "We exhibited small electric motors in our show window directly connected to coffee grinding and meat-chopping machines, and secured remunerative contracts within a few days, which often resulted in electric lighting being installed, where it could not otherwise have been so readily accomplished." Another answer says: "We find that our letter heads, which demonstrate some use of electricity referred to in the subject matter of the letters, have given us very good results." Other companies mention the satisfactory results obtained by the placing of irons on free trial and the placing of tungsten fixtures and lamps upon a monthly rental basis.

Apparently there is not a single Edison company that does not consider a display room of advantage in supplementing selling arguments with a concrete demonstration. Display rooms, however, should be in the proper environment. As a concrete illustration of this fact, a company is cited which, during the past two years, has moved its offices and display room from what might be termed a side street to a main thoroughfare but one block distant, increased its gross display room sales from $1,700 per annum to over $17,000 during the past year; the approximate yearly revenue from energy consumed by the use of the articles sold in the latter year being $6,000.

Some of the companies evidently have the idea that the department store or electrical jobber can take the place and can accomplish the same results as the display room, but opposed to this is the fact that up to the present time there are not a sufficient number of electric heating and cooking utensils and other devices sold to warrant the manufacturer, the retail or the department store making a specialty of such apparatus. Electrical apparatus, also, cannot be sold as are toys or dress goods, etc., by inexperienced salespeople. The salesman in an electrical display room must be familiar with the use of each article, the energy required to operate it, the various conditions of service, and the various methods of obtaining it. The authors say that experience has shown that the showroom should be a lobby or main entrance through which present and prospective customers are obliged to pass. It is desirable also in order to obtain the best advertising effect that corner locations be secured and provision made for extensive show window display. The display room should be divided into two parts, one section to contain all the smaller household devices, heating and cooking appliances, vacuum cleaners, sewing machines, sweepers, etc.; the second section containing the larger electrical appliances such as refrigerators, freezers, dish washers, a complete motor exhibit, etc. It would, of course, be desirable to have the entire exhibit upon the same floor, but in the larger cities, and in many of the smaller ones, floor space, on the ground floor particularly, is of such value that such a layout is financially impracticable. The next best arrangement is to have the ground floor devoted to section one and the basement, in a room approximately the same size as the ground floor, devoted to section two.

The personnel of the selling force should be a matter of some concern to the management. Good salesmen and saleswomen must be secured, and the necessary electrical knowledge and familiarity with conditions affecting the sale of electrical apparatus can be acquired easily by one having sales-making genius. Household devices and toilet accessories are best sold by women, who also make admirable demonstrators of electric irons, cooking apparatus and vibrators in the home. Men are more effective in selling apparatus used in places of business.

The thoroughness of the equipment of a display room depends very much upon what the company is willing to spend upon the installation, but the advertising value of the room will depend very much upon its variety and upon the interest which can be taken in it by the visitor, viewed from the standpoint of an exhibit. An effort should be made not only to have a complete line of the various types of electric lamps and fixtures and of the more important small motor applications, but also to install as many as possible of the electrical household appliances which make for comfort and convenience, together with those electric novelties which catch the eye and arouse the interest. It is a very simple matter for a good salesman to direct the mind of an inquirer from an electric novelty about which he or she professes an interest, to the more serious and necessary daily applications to which electricity has lent itself.

The advertising of a display room after it is once established may be done in one or more effective ways. Some companies run cards in the daily papers inviting the public to inspect the display room and calling attention to the facilities offered for a thorough demonstration of the various electric utensils on sale. Inserts with monthly bills, etc., have also been employed. Judging from the answers received, there is some difference of opinion concerning the advisability of conducting show-window demonstrations in order to advertise the display room and attract the attention of the passerby. There is no question that anything in motion attracts attention; but the conservative element decries window demonstrations as lacking in dignity, especially where the window is located in a prominent locality.

One of the companies calls attention to a unique form of window display which, in the opinion of the authors, is worthy of record. Over a kitchenette placed in the rear of the window, is placed a dial, 10 or 12 in. in diameter, with the dial finger attached to the shaft on the fifth wheel of an old-style meter. This dial finger travels around the dial once for each kw-hour of energy metered, and the dial face is calibrated to show the cost in cents or fraction thereof. By this arrangement and properly worded placards for each piece of apparatus used, the exact cost of operating each article is shown. The meter is wired so that any utensil on the kitchenette may be switched in and the cost of energy shown as outlined.

During the past few years central station companies have participated from time to time in the various exhibits and electrical shows given in large cities. The authors state that a complete installation of household appliances, attractively arranged with practical demonstrations by skilled operators, will invariably dominate an entire exhibition of this character.

In the display room notes forming part of the paper the methods used by various companies to stimulate the sale of energy-consuming devices are given. One central station manager bought a portable vacuum cleaning outfit operated by an electric motor which he rents out at $5 per day. He has found no difficulty in keeping it busy, and the returns from the use of the cleaner, together with the energy consumed, make it a

profitable venture. Another company in a Western city paid the living expenses of a woman solicitor and allowed her 25 per cent commission on each flat iron placed by her on a 30-days' trial. The solicitor sold in eight days 96 irons at $4 each, which cost the electric light company $3.25. The board of the solicitor amounted to $9.50, carriage hire $24, and the profit made by the lighting company $38.50. In addition, the estimated income per annum from each iron was $7 for energy consumed.

Method of Hanging Heavy Wire.

By G. B. BENNETT.

In the issue of Sept. 19 there appeared an article entitled "A Heavy Conductor Open-Work Installation," and having had to meet somewhat similar conditions as those mentioned in the article, the writer submits a description of the methods used.

The building wired is timber framed instead of steel framed, and as the timbers on which the conductors are carried also support the floor of the second story, it was necessary to run the conductors under instead of over them. Fig. 1 shows the

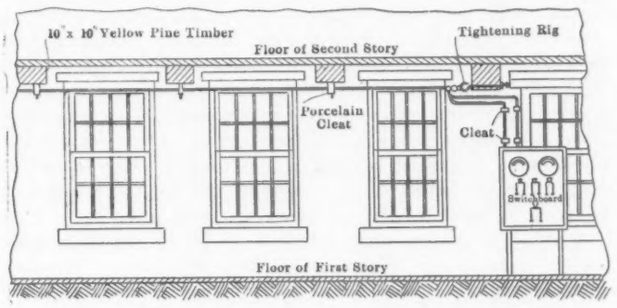


FIG. 1.—GENERAL VIEW OF INSTALLATION.

construction of the building and the relation of the conductors to its members. The structure is of the mill type with side walls of brick, and columns, beams, roof and floors of wood. The beams are spaced 10 ft. center to center. It was necessary to carry a 220-volt feeder composed of two No. 0 stranded, slow-burning wires from a switchboard near one end of the building to a distribution center 120 ft. distant. The wires are supported on each floor beam by a porcelain cleat of the type shown in Fig. 2. This cleat is very rugged and is manufactured in a

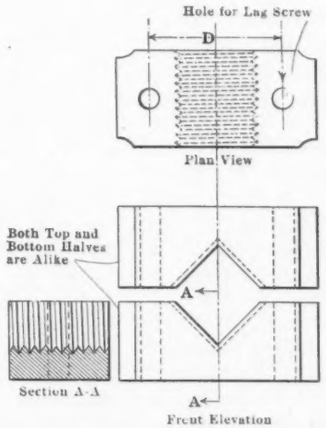


FIG. 2.—DETAILS OF PORCELAIN CLEAT.

range of sizes, one of which will accommodate any wire that would be supported by this method.

Fig. 4 shows how the conductor was clamped between the cleats at each beam. Small gimlet-pointed coach screws with a punched wrought-iron washer inserted under the head of each screw, held the porcelain to the wood. In erecting, a piece of cord was stretched the entire length of the run along the center line of the proposed location of the wires. On each side of this center line, 3 in. distant, points were located on each beam. At these points holes, somewhat smaller in diameter than the diameter of the screw, were bored. One of the coach screws supporting the cleat was turned in each hole, and a hole for the other screw was bored at a proper distance *D*, Fig. 2, from the first one. The 6-in. spacing between the conductors satisfies Code requirements (Rule 24-h).

The coach-screw holes having been bored, the cleats were

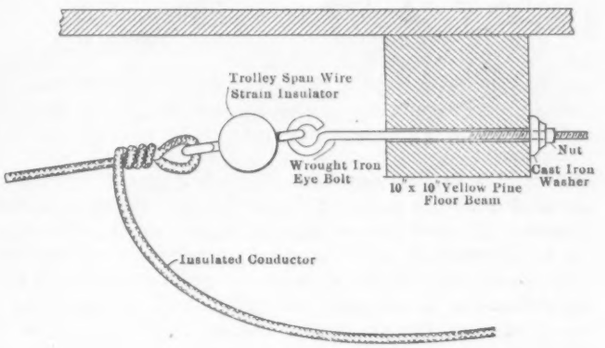


FIG. 3.—DETAILS OF TIGHTENING DEVICE.

placed in position with the wires strung through the grooves. The screws were tightened, but not sufficiently to prevent free longitudinal movement of the conductors in the grooves. After erection, the wires were tightened by the device shown in Fig. 1 and in detail in Fig. 3. The trolley span wire or strain insulator, Fig. 3, was purchased from the local street railway company and the wrought-iron eye-bolt was made by a blacksmith. The cast-iron washer is a staple article and can be purchased in any hardware store. Four tightening devices were used, one

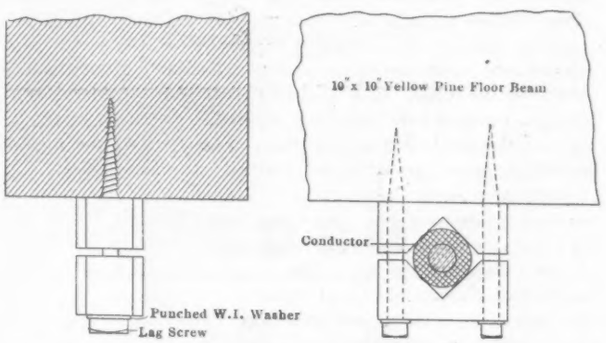


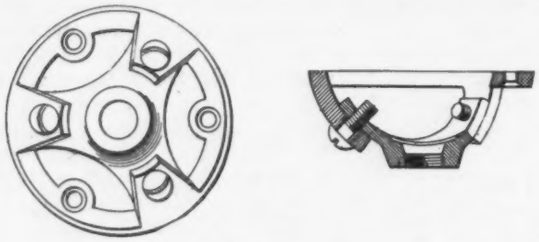
FIG. 4.—SHOWING HOW CLEATS WERE CLAMPED TOGETHER.

for each wire at each end of the run. Fig. 3 illustrates how each conductor was "made up" through the strain insulator eye, and Fig. 1 illustrates how the conductors were led down the wall to the switchboard in cleats of the type shown in Figs. 2 and 4. The resulting installation was very satisfactory, both in appearance and cost. The scheme for laying out holes for the cleat screws from a center line could be used elsewhere in wiring work to advantage.

New Fixture Tripod.

Practice has shown that when a fixture is secured to a plastered ceiling it will nearly always be out of plumb owing to unevenness in the surface of the plaster. When the ordinary one-piece tripod is used, the only way to remedy this is to loosen the screws holding the tripod to the ceiling and wedge it down with washers or pieces of cardboard or other material. This requires time, and at best gives only a botch job when finished. Moreover, in the case of the old-style tripod, wire-

men usually fasten the fixture to it before installing it. When this is done the starting of the screws through the plaster will cause the plaster to crumble and fall within the canopy which has been dropped down on the stem to permit access to the screws. Then, when the canopy is slipped up into place, the



FIXTURE TRIPOD.

plaster will lodge between the canopy and stem and scratch the casing of the latter, removing the lacquer and causing it soon to tarnish. Of course, the old style of tripod can be put up first, but in screwing the stem of the fixture into it, at least six turns are required and the wires in the stem are liable to become short-circuited. To obviate these objections is the object of a new form of tripod for which a patent was issued Oct. 20 to Edwin A. Emery, of Galva, Ill. As will be seen in the accompanying illustration, the tripod is in two parts. The upper or main part of the tripod may be screwed to the ceiling or wall first and the electrolier or bracket having the smaller part of the tripod screwed upon it may have its arms inserted between those of the main part and turned until the screws can be put in and tightened. This also makes it convenient if the fixture has to be taken down for repairs as none of the screws that hold it to the ceiling has to be disturbed. The arrangement also permits simple adjustment to make the fixture hang plumb.

New Telephone Patents.

SWITCHBOARD APPARATUS.

Mr. E. B. Craft has made and patented an improvement in switchboard lamps. It has always required considerable ingenuity to provide suitable lamp terminals and base block, because of the small size of the parts. Fig. 2 shows the method adopted to secure the terminal plates to the base block. The

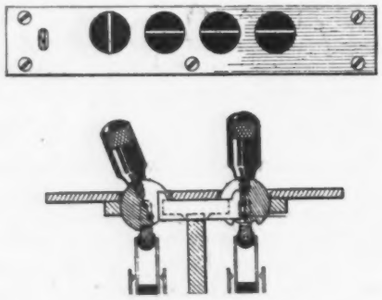


FIG. 1.—BRADBURY KEY.

patent for this lamp has been assigned to the Western Electric Company.

In Fig. 1 are shown two types of party-line key indication covered by patents granted to C. C. Bradbury, which patents are assigned by him to the Kellogg Switchboard & Supply Company, of Chicago. In the upper part of the figure is shown a push type of key. Normally, all the white strips are in alignment. When a push is depressed, a pin riding on a cam causes the button to turn, and when the pressure is released the push returns, but the button remains turned. When another button is depressed the first is released so as to turn its strip back into alignment. In the lower part of the cut a lever key is shown. The lever remains tilted after use until restored by a subsequent action.

AUTOMATIC RINGING CONTROL.

Wherever automatic ringing is used—that is, ringing which is initiated by some act of the operator and which continues at stated short intervals—there must be provided some means of cutting off the ringing current automatically when the called station responds. This is usually accomplished by the use of a magnetic relay, properly adjusted to fail upon the currents carried through it when the distant bell is in circuit, but to operate where this bell is shunted by the talking apparatus. Such an arrangement works satisfactorily for constant frequency of ringing current, but where harmonic ringing is used, not only does the impedance of the relay become effective in retarding the higher frequencies, but we pass beyond the range of adjustment for the wide range of currents. To overcome this difficulty W. W. Dean has invented a system employing a con-

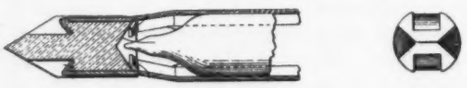


FIG. 2.—CRAFT SIGNAL LAMP.

denser relay. This comprises a leaved condenser, with the leaves held together at one end only, the other end being free to expand. As this condenser becomes rapidly charged and discharged, the mutual attractions and repulsions set up cause a fluttering of the leaves, which in its cumulative effect causes a considerable variation in thickness of the freer end of the condenser. A contact controlling the ringing relay is so arranged that the normal ringing currents will not cause sufficient agitation to break it, while abnormal currents will.

Another scheme is that patented by R. H. Manson, who uses a thermal type relay shunted by a condenser. The hot wire responding to increased currents causes the control circuit to open. The condenser shunted across the hot wire serves as a regulator to cause the relay to act with a constant time factor, whether its heating current be alternating or direct.

The patents for both the above systems are assigned to the Dean Electric Company.

Letter to the Editors.

The Ratio of Transformers.

To the Editors of Electrical World:

Sirs:—I am pleased to note that in your editorial columns for Oct. 17 you raise the question of the definition to be given to the expression "ratio of a transformer." The Standardization Rules of the American Institute of Electrical Engineers do not include this in its list of definitions, and as I pointed out in the Electrical World for July 11 last, it is very desirable that some agreement be reached in the use of this term. The usage at present is very variable, and until a definite usage is adopted it would seem that every man is at liberty to follow his own inclinations, within limits. In order to prevent any misunderstanding, I was careful in my article on "The Effect of Wave Form Upon the Ratio of Transformers" to define my own use of the term. Unfortunately, however, my statement was altered in passing through the editorial office by the addition of the phrase "a step-down transformer being assumed." No such assumption is made, and as defined by me, every statement concerning ratio in the article mentioned is equally true for step-up and for step-down transformers.

I am glad to have this definition criticised, for it is only by such criticism that different points of view are uncovered and the best use of the term finally decided. While being criticised, however, I think it only right that my words should reach the public in the same form as they left my hand.

Regarding the merits of the definition itself, my experience is that most persons use a ratio greater than unity to indicate a step-down transformation and a fractional ratio to express

a step-up transformation. This is especially true in regard to the current ratio of series transformers. These are nearly always step-down transformers, and the ratio is spoken of and marked on the name-plates by the manufacturers as a number greater than unity—never as a fraction. The ideas conveyed by the several expressions "transformation from ten volts to one volt," "transformation in ratio of ten to one," "ratio of transformation ten to one," "ratio 10:1," all seem to lead in the same direction and suggest the evolution of the term. It is rather confusing to use the last expression to mean the direct opposite of the first. Unless there be some grave objection to the general usage, it would seem natural and wise to adopt that usage as standard practice.

WASHINGTON, D. C. M. G. LLOYD.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Joints in Transformer Iron.—H. BOHLE.—For the determination of the no-load currents of transformers a knowledge of the magnetic reluctance of the joints in the iron core is necessary. The usual practice consists in assuming that each joint is equivalent to a film of air 0.005 cm long, this being the mean of a number of values obtained by Prof. Ewing. However, these figures were based on tests with solid rods, whereas for transformers only laminated cores are employed. Moreover, the tests were made with butt-joints alone, and data for overlapping joints are not available. Two magnetic squares were built up by the author, one jointless, the other consisting of stamping capable of being placed together so as to form abutting or overlapping joints, without altering the mean length of the magnetic path. The results of the tests of the author are given in a table. Butt-joints were tested both rough and machined and both non-compressed and compressed. A machined butt-joint when not compressed is no better than a rough one. In both cases the length of the equivalent gap is reduced considerably when compression is applied, especially in machined joints, which are almost as good as overlapping joints. The reluctance of the latter, although lower than that of the ordinary butt-joint, is by no means a negligible quantity, especially for high flux densities. It would appear from these tests that a mean value of 0.005 cm per single gap would meet the case for all butt-joints. Experience has, however, shown that this is hardly correct. Since in the tests of the author the sheets were assembled with the greatest care, it will be safer in ordinary practice to use values of 50 or even 100 per cent higher. As regards overlapping joints, a gap length of 0.004 cm will in most cases give results on the safe side. When cores are so placed together that the stampings cross one another, it is essential that a thin sheet of insulating material be inserted to prevent the production of eddy currents near the joint. The thickness of the insulation should then be added to the equivalent gap. As regards the setting up of eddy currents, overlapping joints are little better than butt-joints, and the type of joint applied will, therefore, depend chiefly upon the class of work for which the transformer is intended. For lighting transformers a small no-load current is of great advantage to reduce the wattless currents. For transformers which are disconnected when power is no longer required, and which are usually fully loaded during service, the wattless currents are of no importance, and butt-joints are not disadvantageous. As regards the manufacturing cost, there is little to choose between the joints except in the case of large transformers, where butt-joints are somewhat cheaper.—Lond. *Elec.*, Oct. 2.

Interpole Machines.—FETTWEIS.—An article illustrated by diagrams on the path of the flux in an interpole machine.—*Elek. u. Masch.* (Vienna), Oct. 11.

Lamps and Lighting.

Mercury-Vapor Carbon-Filament Lamp.—R. HOPFELT.—An illustrated paper read before the Berlin Electrical Society. His lamp, which is shown in Fig. 1, contains a filament in a U-formed tube. This tube also contains a drop of mercury, and an indifferent (inert) gas. Hydrogen or nitrogen might be used, but each is found not to be entirely indifferent, since it attacks the carbon filament. The indifferent gas which he really uses is not specified. The theory of the lamp is that an ordinary carbon-filament lamp cannot be operated at a lower specific consumption than is used in practice, because the increase of power to a lamp, while increasing the candle-power to a greater degree, yet results in vaporization of the carbon filament and the blackening of the globe. The life would, therefore, be shortened. The author tries to suppress the vaporization by filling the globe with an inert gas. However, this method has the disadvantage that the heat is conducted away too rapidly. This disadvantage is now claimed to be overcome by the use of mercury. The mercury vapor is stated to act as a "heat protector." A more concise explanation is not given. It is emphasized that the spectrum of the light does not show the characteristic mercury lines. The external globe surrounding the U-tube is not evacuated. The lamp is operated at from 1.6 to 1.7 watts per candle-power at the beginning. The lamps are claimed to become better with age. The life is given as from 200 to 300 hours, and that of the recent improved lamps as from 400 to 500 hours. The lamps are stated to be less sensitive with respect to vibrations than ordinary carbon-filament lamps. The candle-power increases during the life. A disadvantage is the greater heating of the globe. In the discussion Wedding and Bloch were very skeptical as to the practicability of the lamp. In a communicated discussion Wedding stated that he recently tested four lamps at 110 volts and found a specific consumption of 1.98, 1.92, 1.98 and 2.04 watts per candle. The life was 24, 24, 48 and 100 hours, respectively. Hopfelt replies that the lamps should not have been tested at 110 volts, but at an original specific consumption at 1.8 watts per candle-power. The shortness of the life in these tests is said to have been due to the fact that they were lamps of older type and that they were used continually. The life of his lamp is shortened by using it continually on account of the heat produced. The more lamps that are placed near together, the greater the heat and the shorter the life. The lamps are stated to have a much longer life in practice, where they are more often switched on and off than in the laboratory, where they are tested continually day and night. Reichsanstalt tests of older lamps have shown a life of 200 hours and a specific consumption of 1.81, 1.68 and 1.88 watts per hefner candle.—*Elek. Zeit.*, Oct. 8.

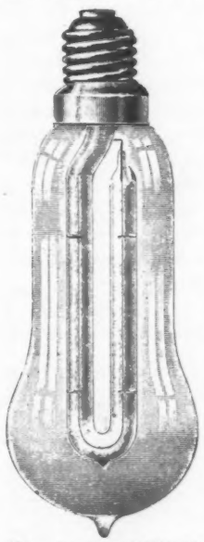


FIG. 1.—MERCURY-VAPOR FILAMENT LAMP.

Twenty-Five-Volt Lighting Circuits.—An editorial note stating that while the small house transformer for enabling 25-volt metallic-filament lamps to be employed on 200-volt alternating-current distributing networks is generally regarded as a more or less temporary expedient, yet "it is clear that the 25-volt private lighting plant has come to stay." At the Electrical Exhibition in Manchester there are many examples of compact 25-volt country-house plants, in which a small generator is driven at high speed by a gasoline or oil engine. The reduction in the number of cells of the storage battery decreases the first cost,

and at the same time lessens considerably the floor space occupied and the labor involved in maintenance and supervision. The advent of the 25-volt systems, however, will necessitate some modification in house-wiring practice that must not be overlooked. Economies in insulating and protecting the conductors can, doubtless, be effected, but there are other directions in which departures from 200-volt practice must be made which may add somewhat to the cost of the wiring work. The ordinary conventional wiring rules can no longer be employed. On 200 volts, 10 16-cp carbon-filament lamps are the rule for a 3-amp circuit from the distributing board. At 25 volts, 10 16-cp metallic-filament lamps will require about 8 amp, while if the same number of watts be taken for the circuit—namely, 600—the allowable current is no less than 24 amp. It is probable that so large a current will be taken only in rare instances from a single circuit of a distributing board, but even putting the limit at from 10 to 15 lamps per circuit, it is seen that considerably larger currents are used than at present. The percentage drop in volts over a bad contact is 21 times as great on a 25-volt, 8-amp circuit as over a 200-volt, 3-amp circuit, and the heat evolved is seven times as great. Moreover, larger wires must be used for the heavier currents.—Lond. *Elec. Eng'ing*, Oct. 8.

Rare Earth Filaments.—A note on a British patent (4461) of G. Michaud and E. Delasson. It refers to a filament for use in the atmosphere and composed of a conducting core and a non-conducting outer envelope. This latter, the radiant part of the filament, is formed of alumina and a mixture of the rare earths thoria and ceria; and a binder of black soap is used. The conducting part may be either carbon, tantalum or any metal of the tantalum group, mixed with a binder of black soap. The former (radiant envelope) mixture is pressed through a nozzle into the shape of a tube, which is dried in the flame of an arc. The conducting mixture is forced through the center of the nozzle into the tube, and is dried at the same time.—Lond. *Elec. Eng'ing*, Oct. 8.

Arc Lamp.—At the Manchester Exhibition a number of miniature enclosed arc lamps and flame-arc lamps were shown. All of these lamps are fitted with a special form of clutch, which works on a simple principle, as shown in Fig. 2. The body consists of a solid brass casting, having a cylindrical hole bored through it, to take the positive carbon, but slotted on the lower end to allow of a soft-iron armature with a steatite grip to be pivoted therein. This armature envelops the top half of the clutch body; at the top end there is a soft-iron core enveloping the body half way round. This clutch is supported in the air-gap formed between the end of the magnet core and the magnet frame. When the current is switched on, a magnetic pull is exerted on the clutch armature, causing the grip firmly to hold the carbon, and at the same time the whole clutch is drawn up, thus striking the arc.—*Manchester Exhibition Supplement*, Lond. *Elec. Eng'ing*, Oct. 8.

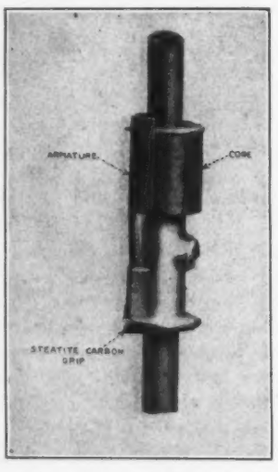


FIG. 2.—ARC LAMP CLUTCH.

Generation, Transmission and Distribution.

Electric Power in Agriculture.—K. Krohne.—The author continues to discuss the use of the electric plough and gives comparative figures, based on extended practice, for the cost of ploughing with electric ploughs, with steam ploughs, with horses and oxen. The results are plotted in Fig. 3. The abscissas represent the depth of flow in inches, while the ordinates give the cost of ploughing. The curve *b* gives the cost for horses, *c* for oxen; curve *d* gives the limits between which the cost varies with steam ploughs, and curve *a* the limits between which the cost varies with electric ploughs. The most important feature of these curves is the proof that with mechanical ploughs (electric or steam) the cost does not increase at the same rate with the depth of the furrows as with oxen and horses. Mechanical ploughing becomes therefore especially profitable for deep ploughing, and this is especially the case with electric ploughs. The author finally deals with the use of electric industrial railways on farms and shows how they can be combined with a system of electric ploughing. Some data are given on the economy of several farms combining to erect a single generating station. The station of Lottin, for instance, has now a rating of 320 kw, of which 200 kw is derived from

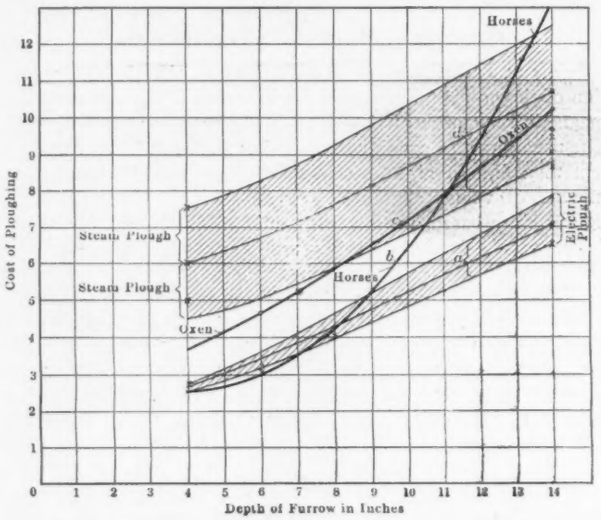

Horses
Oxen
Steam Plough
Steam Plough
Horses
Oxen
Electric Plough
Cost of Ploughing
Depth of Furrow in Inches
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
1 2 3 4 5 6 7 8 9 10 11 12

FIG. 3.—COST OF PLOUGHING AS FUNCTION OF DEPTH OF FURROW.

water power and 120 kw from steam. The energy is distributed over lines of an aggregate length of 137 km to 52 transformers of 1100 kw rating and is supplied to 61 farms and five towns. In the year 1907 about 333,000 kw-hours were used for agricultural purposes and about 93,000 for other industrial purposes and lighting. The energy was sold at 3 cents per kw-hour for motors and at 6.75 cents for lamps. The financial condition of the station was satisfactory. The generators were fully utilized. Energy for ploughing could be supplied only at certain times. It is the intention to enlarge the station.—*Elek. Zeit.*, Oct. 8.

Coke-Oven Gas for Power.—Battig.—Data on the results obtained in two power plants operated with coke-oven gas. They have ratings of 1850 hp and 4000 hp, respectively. For the station of 1850 hp the invested capital was $147,500, or $80 per horse-power installed; interest, amortization and repairs, $20,404; annual energy production, 5,400,000 kw-hours. The cost per 1000 kw-hours was $7.13. This cost contains an item of $2.50 as "cost of gas." For the 4000-hp station, the capital is almost $200,000, or $49.75 per horse-power installed; interest, amortization and repairs, $30,400; the annual energy production was 9,500,000 kw-hours. The cost per 1000 kw-hours was $6.58, which contains the same item for $2.50 for cost of gas. It is stated that the reliability of large gas engines has now been fully established in practice, but it is important to carefully clean the gas and carefully lubricate all rotating parts. It is important to select a sufficiently large size for the gas engines on account of their inability to carry an overload.—*Glückauf*, 1908, Vol. 44, page 1075; abstracted in *Elek. Zeit.*, Oct. 8.

Scientific Control of Fuel Consumption.—H. E. Armstrong.—A note on an Iron and Steel Institute paper in which the author spoke on "the cut-throat policy pursued with regard to the world's raw materials, especially fuel, both coal and oil." He is of the opinion that, in allowing the unrestricted export of its manufacturing life, England is parting with its heritage at a very small fraction of the potential value. He, therefore, pleads for something more than the mere occasional control of fuel

consumption, whether in ironworks or elsewhere, and for the introduction of a new attitude toward the problems of combustion and fuel economy. In this connection ignorance has not a little to do with our difficulties, and is helped by our calm contempt of the complexities surrounding the whole subject of combustion. It has, however, been shown that moisture is a necessary factor, but the process is by no means simple, and scarcely anything is known of the influence of surfaces on the interchanges involved in combustion. This subject is of great importance from a practical point of view, on it depending the way in which fuel is utilized. The author then considered the methods at present in use for converting fuel into energy and shows that they are, on the whole, highly inefficient, while the direct conversion of the energy latent in fuel into electric energy presents many difficulties. In conclusion, he appeals for more chemistry in engineering and for a more rigid control of the irreplacable stores of fuel.—Lond. *Elec.*, Oct. 2.

Accident in Railway Supply System.—An article on a recent accident at the Chelsea generating station in London. The station supplies energy to the District Railway, three tube railways and (through a 10-mile trunk main) sections of the London United Tramways. The initial cause of the trouble was the burning-out of a series transformer on a machine circuit. The transformer exploded, and this short-circuited the main oil switch. The current surge, due to the earthing of one phase, overtaxed the static dischargers on the feeders, so that the busbars were earthed, and it was necessary to "shut down" the station. Considerable time was consumed in cleaning up the earth connections on the 186 static discharge panels, and in insuring that it was safe to put 10,000 volts on the busbars again.—Lond. *Elec. Eng'ing*, Oct. 8.

Traction.

Single-Phase Traction.—H. BEHN-ESCHENBURG.—The conclusion of his long article on single-phase traction motors of the Oerlikon Company, and the experience had on the Seebach-Wettingen line, especially with respect to induction effects on telephone lines in the neighborhood. The author gives full data of a 900-hp single-phase motor designed by the Oerlikon Company. Four such motors are to be used on a locomotive with a rating of 3500 hp. The total torque will be 15,300 kg, the normal speed 60 and the maximum speed 90 km per hour. The weight of the motor, including the gearing, is 9.1 tons. The efficiency is 92 per cent at full-load and 90 per cent at half-load. The power factor is 0.95 at a speed of 60 km and 0.90 at a speed of 30 km. The starting torque is double the normal torque and the starting current is 1.7 times the normal current; the power consumption at starting is 30 per cent of the normal value. The author then compares the compensated series type of single-phase motor with the Winter-Eichberg type and thinks the former is preferable. The Winter-Eichberg type is superior with respect to commutation only at synchronous speed, but the choice of the number of poles is then limited and more brushes are required. He finally gives a comparison with direct-current and three-phase traction. He thinks that the single-phase system has now been furthest advanced. He thinks that it would not be difficult to operate a direct-current line at 3000 volts using 600-hp motors at 1500 volts, running at a speed of from 700 to 1500 r.p.m. The design of such motors has been worked out. They have four main poles and four interpoles and weigh about 7700 kg, including the gearing. The efficiency is 94 per cent. To make the starting torque double the normal torque they consume 1.6 times the normal power at starting. With respect to weight, the direct-current system has hardly any advantage. The efficiency of the motors is about 5 per cent higher than that of single-phase motors and transformers, but this advantage is counterbalanced by the losses in the rotary converters. With respect to three-phase traction the author points out the difficulty of speed regulations and gives data to show the superiority of the single-phase series motor with respect to starting torque, overload range and power factor. He finally explains why he thinks that a frequency of 15 is the best for traction.—*Elek. Zeit.*, Oct. 8.

Low-Tension Distributing System for Railways.—F. E. WYNNE.—A continuation of his long serial on electric railway engineering. He deals with the design of the low-tension distributing system, comprising track rails, bonding, trolley line of third-rail and feeders. He describes the method of determining the size of electric track rails and of third-rails, deals with line voltage regulation, describes the use of the train sheets (showing the location of the several cars in service at any time), the determination of the location of substations and the calculation of the trolley and feeder sizes, and the selection of the contact line. He finally deals with the calculation of the weight of copper required and the determination of the losses.—*Elec. Jour.*, October.

Accumulator Railway Cars.—An illustrated article stating that two of the 57 storage-battery railway cars ordered for the Prussian State Railways have been delivered and are in service near Berlin. The design of the cars is quite different from that of the original cars in use at Maintz, in southern Germany. Instead of placing the cells under the seats of the passengers' compartments, they are arranged in special shallow compartments in front of the driver's cabin. Each unit consists of two four-wheel cars, each car being equipped with one 80-hp motor and a battery of 84 cells. A run of over 60 miles can be made on one charge.—Lond. *Elec. Eng'ing*, Oct. 8.

Electric Ferry Boat.—A fully illustrated description of an electrically-propelled ferry boat which has been put into service recently on the Rhine. It is a twin-screw vessel, and is designed to carry 645 passengers. The electrical equipment comprises two 50-hp interpole series motors and a battery of 160 cells, with a total rating of 335 amp-hours on a one-hour discharge. The motors are controlled by levers in the navigating cabin where the instruments are placed. Two small motors are provided for operating the landing gangways, and an electrically-driven pump is also installed. Plug contacts for charging are provided at the landing stage on one side of the river.—Lond. *Elec. Eng'ing*, Oct. 8.

Installations, Systems and Appliances.

French Central Station Statistics.—The complete issue is filled with the statistical tables on central stations for the distribution of electrical energy in France and its colonies. The figures refer to the first of January, 1908. The tables fill 65 full pages. There are some introductory notes, but no summary of the tables given. A rough guess shows that the data are given for about 2000 stations. Some of the transmission systems are quite large, extending more than 60 miles from the generating station. In some cases three-phase transmission at voltages as high as 50,000 and 53,000 is used. The number of stations producing direct current is greater than the number of stations generating alternating current, but the total power is greater in the alternating-current stations than in the direct-current stations. The voltage of the distribution network is almost everywhere 110 or 120. The number of 200-volt lines is small. This is a distinct difference from English practice, but it facilitates the introduction of the new metallic-filament lamps. In the alternating-current systems a frequency of 50 appears to be the standard. The use of meters at the consumers' houses increases more and more. The prices for energy vary greatly. For lighting they vary between 10 cents and 20 or 24 cents per kw-hour. For industrial purposes the price is as low as 6 cents and even less in certain important stations.—*L'Industrie Elec.*, Oct. 10.

Storage Batteries.—P. R. MOSES.—Having formerly discussed the conditions to which the storage-battery system is best adapted in isolated electric plants, he now considers the storage battery as an actual part of the generating equipment. He discusses the charge and discharge of the battery. The various types of boosters and other auxiliary equipment and the economies which may be effected by the use of the system are discussed.—*Eng'ing Mag.*, October.

Meter and Relay Connections.—H. W. BROWN.—In a continuation of his serial in which he formerly described standard connections and indicated how individual meters and relays are connected, he now discusses the combinations of instruments

and methods of grouping them, and describes special connections for using instruments for certain purposes. He first deals with the uses of instrument transformers, both series and shunt, and then gives a review of single-phase connections for two-wire circuits, for three-wire circuits and for the monocyclic system.—*Elec. Jour.*, October.

Substations.—An illustrated description of the substation at the Manchester Electrical Exhibition. It has been erected by the Manchester Corporation, and the plant will subsequently be transferred to permanent substations. Large machines have been put in, as the exhibition load is heavy. A rotary converter, with a specially arranged booster on the same shaft in order to give a very large range of voltage regulation, is one of the three machines put in. The detailed arrangements of the wiring of the exhibition are also described.—Lond. *Elec. Eng'ing*, Oct. 1.

Electrophysics and Magnetism.

Spark Resistance.—D. Roschansky.—Two papers on the resistance of spark discharges. It seems that in general it is incorrect to speak of spark resistance. It is equally wrong to speak of the resistance of an arc. But in special cases, namely, at high frequencies, the path of the spark may be considered as an ordinary conductor. Simon's dynamic theory of the arc when applied to the oscillatory spark discharge permits one to find the voltage curve for the spark. A comparison with the experimental results shows a satisfactory agreement of the theoretical form of the voltage curve with the experimental one. Quantitatively there is some discrepancy.—*Phys. Zeit.*, Oct. 1.

Formation of Gas in Discharge Tubes.—R. von Hirsch.—The author formerly showed that when cathode rays are produced in discharge tubes with the aid of an influence machine the relation $p^3 e$ exists between the vapor pressure p and the discharge potential e, if the tube is filled with a single pure gas, but that this relation does not hold good for mixtures of gases. With ordinary aluminum electrodes which contain sodium, the discharge sets free a gas for which $p^3 e$ is constant. It was, therefore, assumed to be a pure gas and it was thought that it might be hydrogen. It was found, however, that it is a mixture of hydrogen and carbon dioxide. The reason why the above law holds good for this mixture is explained.—*Phys. Zeit.*, Sept. 15.

Electrochemistry and Batteries.

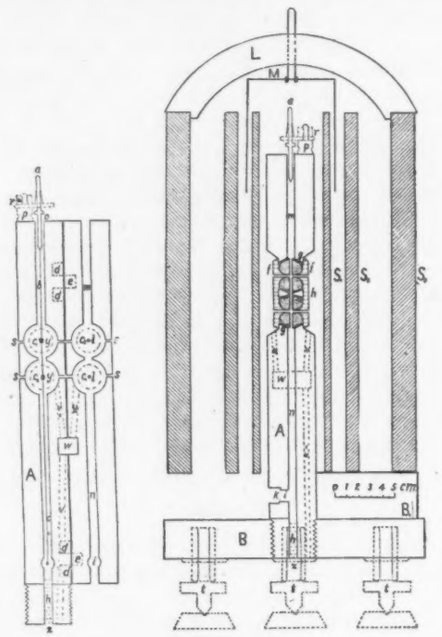
Iron Sheets and Tubes by Electrolysis.—S. Cowper-Coles.—An illustrated description of an electrolytic process for making tubes and wires in one operation from crude or scrap iron (that is, without the necessity of melting, rolling, etc.). The electrolyte employed consists of a 20 per cent solution of sulphocresylic acid saturated with iron. It is possible to change the content of carbon in the deposit of iron.—*Electrochem. and Met. Ind.*, November.

Electrolytic Gold Refining.—E. Wohlwill.—An article with reference to the application of his process of electrolytic gold refining to an alloy containing 60 per cent of gold and known quantities of silver, copper, lead, zinc, iron, etc. The author analyzes in great detail the reasons why such an alloy would not be suitable for electrolytic refining. The refining process requires a relatively pure material high in gold. The proper value of the current density must be chosen according to the composition of the anode material. If interest is to be charged for the gold stored in the process, the conditions of operation must and can be so arranged as to make the interest charge a minimum.—*Electrochem. and Met. Ind.*, November.

Silicon Electrodes.—F. G. Wick.—The last article in his serial on different electric properties of metallic silicon. In the present paper he gives figures for the e.m.f. of cells in which silicon forms an electrode. The results of these experiments do not indicate that silicon has any great value as one electrode of a voltaic battery. "In generating e.m.f. it has practically the same effect as carbon." It has, however, the disadvantage of a higher resistance, which reduces the available current. "Various physical characteristics make the manipulation of silicon so difficult as to discourage attempts to use it for practical purposes."—*Phys. Rev.*, October.

Units, Measurements and Instruments.

Galvanometer with Magnetic Shielding.—E. F. Nichols and S. R. Williams.—A description of a convenient form of galvanometer with magnetic shielding, shown in Figs. 4, 5 and 6. The upright *A* was made from a solid round brass rod, sawed through the axis, and the surfaces carefully faced, leaving elevations and depressions *e d* for hinges. A slot *m m* along the axis was cut out to receive the suspension *a b c*. The halves were then firmly fastened together and turned down to a diameter of 3.8 cm, and a screw-thread turned on the lower end to attach it to the circular hard-rubber base *B*. Just above this screw one of



FIGS. 4 AND 5.—GALVANOMETER WITH MAGNETIC SHIELDING.

the halves was sawed through in a plane normal to the axis. This half of the rod was hinged to the other and served as a door. The rounded surfaces of both halves were milled out at *f*, as shown in Fig. 5, and transverse taper borings at *g* were made to receive the coils c_1, c_2, c_3 and c_4, which were set into place with beeswax *h*. With the door closed, the space between the coils facing each other was 2½ mm, just sufficient to allow the needle-system room to turn around. The door was also bored at *i*, and mica window *k*, with its plane inclined to the vertical, was set into a recess, as shown in Fig. 5. When the door

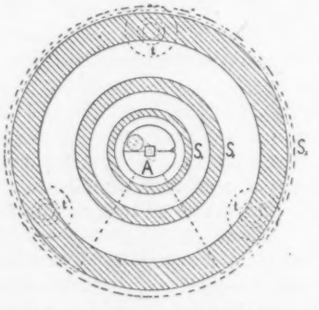


FIG. 6.—CROSS SECTIONAL VIEW OF GALVANOMETER AND SHIELDINGS.

was closed a hard-rubber disk *B*, bored out at the center to fit the gently tapering upright, could be slid down over the upright, which it snugly fitted at the bottom, and thus the door was kept tightly closed. Out of this rubber disk *B*, which served as a support for the magnetic shields, a sector was cut opposite the window *k*, to permit the observations of deflections. This arrangement is shown by the dotted lines in Fig. 6, which represent a plane of the base. The arch *L*, bored at the top, carried a control magnet *M*, made of bent clock spring, by

which the zero point and sensitiveness of the galvanometer could be changed at will. The upper end of the quartz-fiber suspension was attached to a rod *O* free to turn in a sheath soldered to a strap of brass. A slot was cut in the brass strip through which the shank of the binding post *p* passed. By these means the suspension could be accurately centered and clamped by the head *r*. By loosening the head when the door was opened the suspension could be swung out from the plane of the rear coils for examination. The rod *O*, to which the fiber was attached, could be drawn out or put in from beneath and was held in place by friction. These adjustments made it very easy to mount and center the suspension or to exchange one suspension for another quickly. Small holes *l* through the axis of the two-coil pairs facing each other and small slots *s* in the halves of the uprights at the heights of coil centers made inspection of the centering of the needle systems possible with the door closed, and the final adjustments of the needles might be made with the leveling screws *t* on the base. The needle system *y* consisted of two groups of seven needles, attached to the thin quartz rod *b c*. Three shields *S* of silica steel were employed and the results could be greatly improved by a special annealing process.—*Phys. Rev.*, October.

Compensation or Self-Inductance in Shunts.—A. CAMPBELL.—In certain types of alternating-current ammeters and wattmeters trouble is experienced if the shunt resistor employed has some self-inductance. This will be especially the case if the resistance of the shunt resistor is low. The author compensates for the self-inductance by making the leads from the potential points of shape similar to that of the shunt and running one or both so as to be almost coincident in position with the shunt resistor itself; this is illustrated in Fig. 7. Thus, for example, if the shunt is a broad strip, one or both potential leads should be in the form of strips of the same breadth and run as close as possible to the shunt. Of course, the leads may be much thinner than the shunt, and of different material. With such an arrangement the potential difference obtained will be, in magnitude and phase, almost exactly what the shunt would give if it were non-inductive. The general explanation of this lies in the

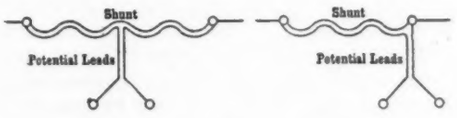


FIG. 7.—SHAPE OF SHUNT RESISTORS.

fact that the magnetic field due to the current in the shunt, while it causes the back e.m.f. of self-inductance in the shunt, causes at the same time an equal and opposite e.m.f. of mutual inductance in the potential leads, and the result is the non-inductive condition desired. An exact mathematical proof of this fact is given.—Lond. *Elec.*, Oct. 9.

Prepayment Meter.—An illustrated description of a simple form of prepayment meter for use on small installations where charging is reckoned on the hours during which energy is used, irrespective of the number of lamps in use. It consists essentially of a clock with an electrically-operated detent, beyond which there is no electrical metering gear.—Lond *Elec. Eng'ing*, Oct. 1.

Cadmium Cell.—P. I. WOLD.—A note on the reproducibility of cadmium cells. An account of the results obtained with a great number of cadmium cells set up at Cornell according to the specifications of Gerhart and Hullet and used during the last three years. From his experience the author concludes that with a little practice and a due amount of care the cells may be set up in any laboratory which will agree with those set up elsewhere within a few parts in 100,000. It is important at this stage in the development of the cadmium cell that they should be set up in as many places as possible in order that data on their reproducibility may be at hand.—*Phys. Rev.*, October.

Bearing Vibrator for Alternating-Current Energy Meter.—A description of a device employed by a British company to ensure that a meter shall start on very small loads. This is accomplished by an automatic bearing vibrator, which is shown in Fig. 8. When an alternating current is sent through coil *O*, the armature *J*, being in an alternating magnetic field, will vibrate. This vibration is communicated to the flat spring *D* and thence to the jewel bearing and spindle *A*. The action is similar to tapping the instrument to get the highest accuracy of the reading. By this means the meter is enabled to start at a very

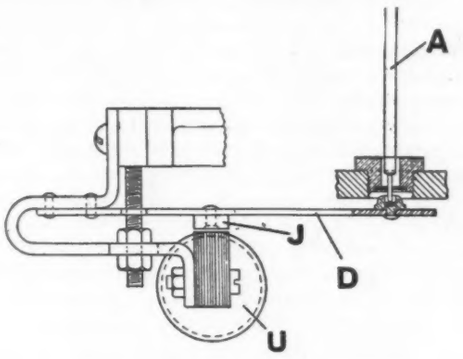


FIG. 8.—DIAGRAM OF BEARING VIBRATOR.

small current, and, the friction being reduced to a minimum, the readings will be quite accurate on light loads. Special precautions are taken to prevent "shunt running." This vibrator may be adapted to meters used in conjunction with small transformers, as it will ensure that the no-load losses are registered by the meters.—*Manchester Exhibition Supplement* of Lond. *Elec. Eng'ing*, Oct. 8.

Wattmeter as Phase Meter.—W. LULOFS.—The author formerly showed that a wattmeter may be used as a phase meter in single-phase circuits, if by employing a self-inductance coil a certain phase difference is produced between the voltage and the current in the voltage coil. He now shows that the construction of the wattmeter becomes even simpler if condensance instead of self-inductance is employed for the production of the phase difference.—*Elek. Zeit.*, Oct. 8.

Telegraphy, Telephony and Signals.

Increasing the Inductance of Telephone Cables.—M. MINIOTTI.—To increase the inductance of long telephone cables, without "loading" the cable with inductance coils at certain distances according to the Pupin system, two methods are possible by which the inductance is increased uniformly all along the cable. The first method is to place an iron envelope around the copper conductor; the second is to wind the copper conductor in spiral form around a central core of iron. The author compares these two methods and reaches the conclusion that the first system is preferable.—*La Lumière Elec.*, Oct. 3.

Directive Wireless Telegraphy.—E. BELLINI AND A. TOSI.—Their complete illustrated (Brit.) Phys. Soc'y paper on their directive system of wireless telegraphy, which has already been noticed in the Digest. The authors first describe their bilateral directive system using closed oscillatory circuits for transmission and for reception, and then also their new unilateral directive method, with the simultaneous use of closed oscillatory aerial circuits and the open oscillator or vertical antenna.—*Phil. Mag.*, October.

Miscellaneous.

Exhibition.—L. ROSENBAUM.—An article on exhibits at the Jubilee Exposition in Prague, 1908, where the manufacturers of electrical machinery in Bohemia were well represented by dynamos, transformers, steam turbines, water turbines, etc.—*Elek. u. Masch.*, Sept. 20.

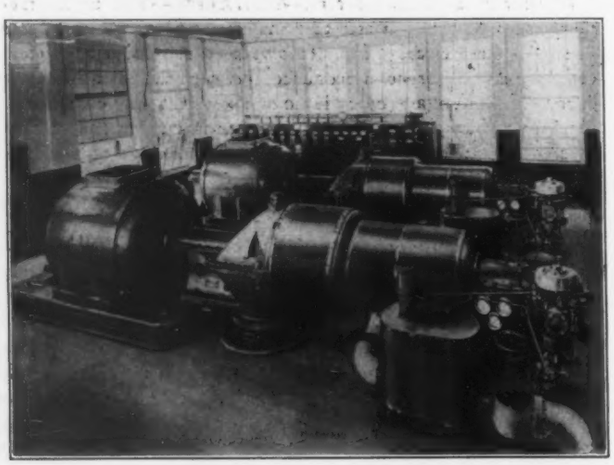
Manchester Exhibition.—Long illustrated descriptions of the numerous electric exhibits at the present Manchester Exhibition may be found in all the London papers, partly in the form of special supplements. Several of the exhibits are or will be mentioned in other parts of the Digest.—Lond. *Elec.*, Lond. *Elec. Rev.*, Oct. 2 and 9, and *Elec. Eng'ing*, Oct. 1 and 8.

NEW APPARATUS AND APPLIANCES

Steam Turbine Plant of the Kerr Mills of the American Thread Company.

In the early part of 1907 the American Thread Company decided to make an addition to its plant at Fall River, Mass. The old plant consisted of a spinning and twisting mill, dye and gassing house. The power for the main mill was derived from a double tandem-compound engine of about 1600 hp, and the dye and gassing houses were driven by small engines, the power from these and the main engine being distributed throughout the various mills by belts and shafting. It was decided to drive the new mill electrically, principally on account of the probability that, as the business increased, various additions would have to be made, and the electrical drive lends itself particularly well to this end. The old mill was also changed over to electric drive.

The power house is located on South Watuppa Pond. The tracks of the New York, New Haven & Hartford Railroad run between the power house and the pond, cutting off a small body of water from the main pond. Connection was made with the main pond at two points, the water being brought into the power house through one of these connections and a trench, and the water from the condensers flowing into the small pond and thence under the railroad, through the other connection, into the main pond. These connections were placed some distance



TURBINE PLANT OF THREAD MILLS.

apart, so that the used water would have no tendency to return to the power house.

The power-house building is of brick with concrete floors and roofs. The boiler room contains 12 200-hp horizontal tubular boilers, built by the Bigelow Company, of New Haven, Conn. These boilers are hung from beam supports and are brick set, the setting being arranged so that superheaters can be installed in the rear end of the setting. Three Foster superheaters have been installed for the purpose of testing their durability and efficiency. The gases from each battery of six boilers pass through a flue of a Green fuel economizer and thence to the chimney. The flue back of each battery is arranged so that the gases can either pass to the chimney or through the economizers. The boilers are arranged for burning low grades of fuel and are equipped with the Parsons system of grates and draft. A Warren-Webster open feed-water heater and purifier is located at the end of the boiler room next to the turbine room. Coal will be brought from the storage piles by a conveyor system and dropped in front of the boilers.

The steam piping is arranged so that superheated or saturated steam can be supplied to the turbines or to the auxiliaries, either separately or in conjunction. The feed water is delivered to the open heater and purifier and is then pumped to the boilers. The feed-water main is of cast iron and so arranged that water can be supplied either from the pond or from the heater and purifier, and delivered directly to the boilers or through the economizer. The drips from all of the high-pressure steam mains are collected at one point and from there returned to the boilers by a Holly return system.

The turbine room has two floors, but the upper floor, where the turbines are located, does not extend over the space occupied by the pumps. This space was left open so that the traveling crane, which is of 10-ton capacity and was built by the Northern Engineering Company, could be utilized in installing and repairing the auxiliaries as well as the turbines. The turbine room contains two 1500-kw Allis-Chalmers turbo-alternators, two 75-kw General Electric direct-current turbo-exciters and a General Electric switchboard. This apparatus is located upon the upper floor level. The turbines operate at 1800 r.p.m., with a steam pressure of 150 lb. at the throttle, dry saturated, and a vacuum of 28 in. of mercury referred to 30-in. barometer at the exhaust nozzle. The bedplate is divided into two parts, one carrying the low-pressure end of the turbine. The turbine is secured to the former, while the latter is provided with guides which permit the end of the turbine to slide back and forth with differences of expansion caused by varying temperatures, at the same time maintaining the alignment. Bulkley condensers are located outside the building.

The speed of each turbine is regulated within close limits by a governor driven from the shaft through cut gears working in an oil bath. This governor, by means of a relay, operates a balanced throttle valve. The entire mechanism is so proportioned as to respond at once to variation of load, but its sensitiveness is kept within such bounds as to secure the best results in the parallel operation of the two turbo-generators in this station. The governors can be adjusted for speed while the turbines are running, thereby facilitating the synchronizing of the generators and dividing the load as may be desired. In order to provide for any possible accidental derangement of the main governing mechanism, there is an entirely separate safety or overspeed governor. This governor is driven directly by the turbine shaft without the intervention of gearing, and is so arranged and adjusted that if the turbine should reach a predetermined speed above that for which the main governor is set, the safety governor will come into action and trip a valve shutting off the steam and stopping the turbine.

Between the turbine and its generator a special type of flexible coupling is used to provide for any slight inequality in the alignment of the bearings, to permit axial adjustment of the turbine spindle and allow for difference in expansion. This coupling is so made that it can be readily disconnected for the removal of the turbine spindle or of the revolving field of the generator. Provision is made for ample lubrication of the adjoining faces of the coupling. The revolving-field alternators driven by these turbines are of standard type, designed for high efficiency and safe operation at high peripheral speeds.

On the lower floor of the turbine room are two engine-driven Lawrence centrifugal pumps for condensing water, one Blake 1000-gal. underwriter fire pump, one electrically-driven Deane triplex power pump for sanitary water for the mills, one Fairbanks-Morse duplex steam tank-pump for water supply to the heater and purifier, one engine-driven Deane triplex power pump, and one Heisler duplex steam pump for boiler feeding purposes. The engine-driven triplex boiler-feed pump is arranged so that it is automatically controlled by the opening and closing of the boiler-feed valves, a constant pressure being maintained on the feed line. Any lowering or raising of this

pressure causes the pump to run faster or slower according to the demand for water.

The level of high water in the pond is about 1 ft. lower than the lower floor of the turbine room. At the end of this room, where the pumps are located, there is a trench into which the water flows. All of the pumps have independent suction pipes from this trench.

The switchboard is located on the same floor as the turbines and consists of two panels controlling the exciters, two panels for the main turbo-generators, one panel for a Tirrill regulator, seven panels for the motor circuits, and one panel connected to the lighting circuits. The switchboard has a complete equipment of instruments, and all switches are oil immersed, except the main generator switches, which are solenoid-operated circuit-breakers. The feeder mains are carried underground to each mill through fiber conduits.

The plant was designed and its construction superintended by S. M. Green, consulting engineer, of Holyoke, Mass.

Factory Cable Testing Apparatus.

The greater the experience of a manufacturer in insulation testing, the more will be the stress which he lays on the complete insulation of all parts of the equipment with which his product is judged. The touch of a damp hand at some critical

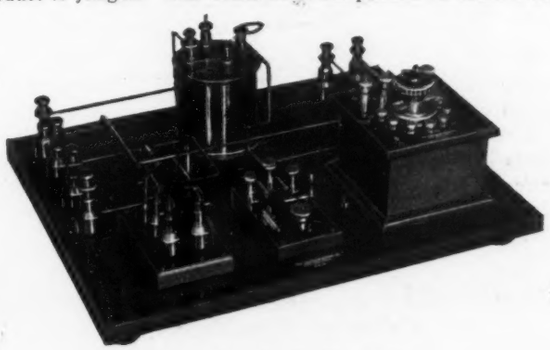


FIG. 1.—CABLE TESTING SET.

point, a film of moisture on a hard-rubber surface, or a transient ground on a nearby lighting circuit, may introduce costly errors in the readings of the apparatus by which the quality of his product is gaged. In factory measurements, where the testing apparatus is permanently located, it is advisable that no precaution be neglected which may guard against the effect of transient grounds. It is best to mount the individual instruments of the testing set so as to secure for them ample insulation, and then to make their connections entirely visible, and open to frequent inspection. This result is best accomplished by running heavy copper wires through the air for making direct connections between the instruments.

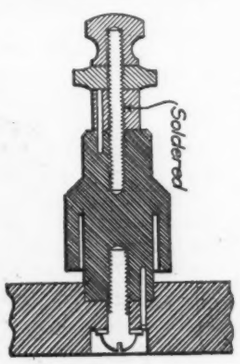


FIG. 2.—CROSS SECTIONAL VIEW OF BINDING POST.

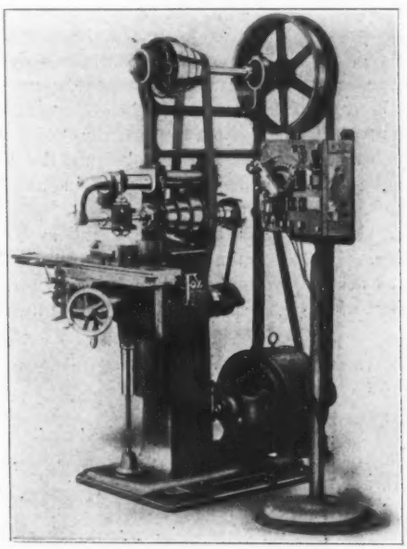
In the testing set illustrated in Fig. 1, use is made of binding posts of the petticoated type. Hard rubber under the action of light deteriorates, owing to the slow conversion of the sulphur in the rubber to sulphuric acid, producing a conducting film over the surface. The petticoated form of post not only affords the maximum length of insulating surface, for a certain height of the post, but it has the further advantage that almost two-thirds of the insulating service is shielded from light, moisture and dirt. A cross-sectional view of such a post is shown in Fig. 2. These testing sets are made by the Leeds & Northrup Company, of Philadelphia. The apparatus consists of a high-sensibility galvanometer, Ayrton shunt, a tenth-megohm resistor, a standard condenser, and the necessary switches and keys. These are mounted on a highly-polished base of hard rubber, which is supported on rubber insulators. All connections are of polished nickel plate, which contributes to the handsome appearance of the set.

Motor-Driven Milling Machine.

The simplicity of a machine designed for a wide range of speed is well shown in the accompanying illustration where a Fox light-milling machine is fitted with a Westinghouse direct-current motor. The specifications under which this machine was manufactured required the speed of the milling spindle to be adjustable over a range of 20-to-1, namely, from 425 to 21 r.p.m. Although only 16 speeds were called for in these specifications and these were obtained by using back gears and speed cones of four steps, it was decided to supply an adjustable-speed motor.

This motor has a speed range of 2-to-1, the speed being variable from 1320 to 660 r.p.m. in 14 steps. This permits of much finer adjustments in the speed of the spindle than would be possible with a constant-speed motor. Therefore, the cutter may at all times be run at the maximum speed which it can withstand, whatever the type of work it is performing.

The speed of the motor is controlled by means of field regulation, that is, the controller varies the resistance in the field circuit and the motor changes its speed accordingly. This con-



MOTOR-DRIVEN MILLING MACHINE.

troller is mounted on a pedestal that is independent of the motor, and may be moved somewhat and located at the most convenient point for the workman.

An interesting feature of the outfit is the method of mounting the motor, on an extended sub-base which is pivoted at one side. The free end of the motor bracket is supported by the short arm of a foot lever which raises the motor and slackens the tension on the belt and allows the spindle of the machine to come to rest without waiting for the motor to stop. The motor is held in the raised position by a foot catch on the front lever. Depressing the catch allows the motor to settle and tightens the belt.

This outfit represents the application of a motor to a standard belt-driven milling machine with a special modification of the base for mounting the motor, and shows how compact the complete outfit with a motor may be, even when the method of applying the power has not been altered. The speed may be varied within the range of the motor by the movement of the controller handle which is located where it is most convenient to reach while at the tool.

Portable Tachometer.

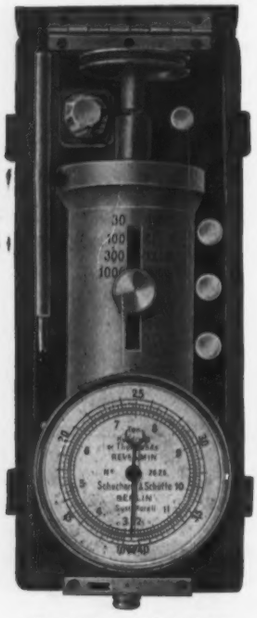
The use of portable tachometers, or hand tachometers, as they are sometimes called, has grown during recent years to important dimensions. For high-speed dynamos, motors, machine tools, etc., the old-fashioned revolution counter has ceased to answer the severe requirements of modern usage. Particularly in the case of motors, the variations of speed render it almost impossible to obtain accurate information by means of the ordinary speed indicator and stop watch.

Reliable stationary tachometers have been put on the market from time to time, but the number of portable tachometers in existence is limited. This is due largely to the fact that portable tachometers are obliged to undergo more severe usage, caused by the necessity for transporting them from place to place and to the handling of them by unskilled operators under conditions unfavorable to a sensitive instrument.

A new hand tachometer, which is said to overcome the difficulties against which portable tachometers have heretofore been obliged to combat, has just been put out by Schuchardt & Schütte, 136 Liberty Street, New York. This instrument is based on the action of centrifugal force on weights pivoted on a rotating spindle. The movement of these weights, when rotating, is controlled by gravity or by springs, and it is indicated by a pointer mechanically connected to them.

The instrument has only one spindle, which suffices for the four speed ranges furnished. The speed ranges are 30 to 120, 100 to 400, 300 to 1200 and 1000 to 4000. The different speeds are obtained with the single spindle by means of a thumb slide which can be thrown into action at any of the four points while the tachometer is operating. An additional safety device is provided which prevents injury to the instrument in case the wrong speed range is used. For example, if the tachometer is used to indicate the revolutions of a motor recording 3000 revolutions and the thumb slide is set at 1200 revolutions, the slide can be thrown into the proper range without removing the instrument from the shaft.

The power absorbed is said to be so small as to be almost indeterminable. The revolutions of a small electric fan can be taken quite as accurately as those of a large motor. In addition, the weight of the instrument is a feature. Its entire length



PORTABLE TACHOMETER.

is 5 in. It is put up in a leather and aluminum case, highly polished and japanned, with all suitable accessories, such as triangular steel points, rubber points and funnel centers, an extension bar for the spindle to facilitate its use in different positions and disk pulleys. The disk pulley is furnished for determining belt, rope and periphery speeds. A V-shaped groove is turned in the face of the disk pulley, and where shafts are not easily accessible the pulley can be driven by a thread passed round the shaft.

The standard tachometer is made to register a maximum of 4000 r.p.m., but similar instruments are made to record 8000 and 12,000 r.p.m. The illustration shows the instrument in a leather case.

Single Strip Type of Conduit.

The latest improvement introduced by the Sprague Electric Company in conduit work is the Single Strip type of conduit shown in the accompanying illustration. This differs from the well-known Greenfield double-strip type in that it is formed with a single strip of galvanized steel, interlocked and gasketed

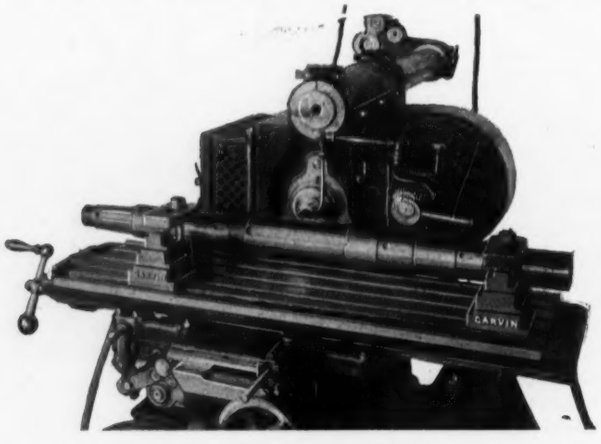
COIL OF CONDUIT.

in such a manner as to be extremely serviceable in concrete construction, as well as in locations liable to dampness.

This new single-strip type of flexible steel conduit is designed particularly for fireproof building construction, but is equally suitable for new non-fireproof work or for the wiring of existing buildings. The Sprague Company also manufactures a full line of fittings for use with this new type of conduit.

Automatic Milling Machine Attachment for Cutting Key-Ways.

In the accompanying illustration a street railway motor shaft is shown wihch is having five key-ways cut at one operation by means of a comparatively inexpensive attachment, known as an automatic milling machine attachment. This device is below the slide secured to the feed box on the left. The automatic features are a forward and back motion controlled by table stops and an automatic feed and trip, also controlled by table stops, which oscillate the double-pawl feed system on the



AUTOMATIC MILLING MACHINE.

in-and-out screw. A limit plate keeps these pawls from engagement on arriving at the proper depth of cut. Tool-post slots and spindle drift slots are also cut by means of this attachment, which is made in three sizes by the Garvin Machine Company, of New York, and can be attached to any of a number of its plain milling machines.

Electrically-Driven Laundry Machinery.

Absence of dirt is one of the most important considerations in a laundry. It is no doubt one of the reasons many people still prefer hand laundry to machine laundry work. There seems to be a feeling that machinery means dirt. This is largely true where the machinery is driven by belts. The shafting and countershafting collect dirt and throw it into the air. Dirt is produced by the friction of the belts on the pulleys and is thrown into the air. Dirt collects on the oil which leaks from the bearings, dries, and is thrown into the air. Some of it lodges on the floor, some on the clothes being laundried.

By using electric motors to drive the various machines the production of this dirt is eliminated. The accompanying photographs show that motors can be attached to the various machines used in a laundry in such a way that there are no exposed belts or gearing, and therefore no dirt is produced from this source.

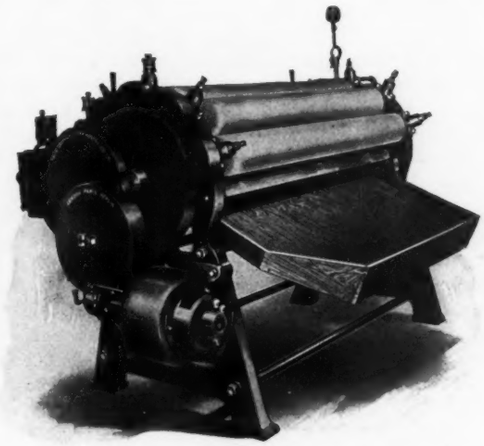


FIG. 1.—ELECTRICALLY DRIVEN LAUNDRY MACHINERY.

There are many other advantages obtained by motor drive for this class of machinery. The various machines can be arranged in any place and in any position, regardless of line shafting. This means that more machinery can be installed in a given space, because with shafting the machines must be arranged more or less in a straight line and space is often wasted. A great saving of power is also effected, as the electric motor draws from the line only the amount of power required to drive the machinery. It is often desirable to run one part of a plant without the other parts. This can be conveniently done when each machine is motor-driven, whereas with belt drive all of the shafting in the plant must be run, in which case the power taken to drive the shafting is much more than the power required to drive the few machines which are running.

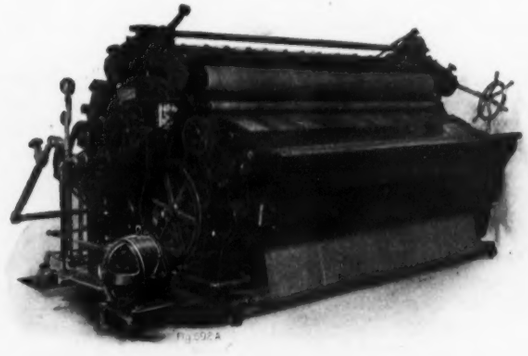


FIG. 2.—ELECTRICALLY DRIVEN LAUNDRY MACHINERY.

The motor applications illustrated herewith were made by the Crocker-Wheeler Company, Ampere, N. J.

New Type Circuit-Breaker.

The general use of circuit-breakers has been limited because of the first cost of the installation, and in order to provide a breaker which shall be able to compare in price with enclosed fuses, the Westinghouse Electric & Manufacturing Company has developed a small carbon-break type, shown herewith.

The illustrations show the compact and neat construction of the circuit-breaker, suggesting the appearance of a cartridge fuse. The tripping device is inside the movable arm, and tripping may also be done by hand by the small insulating handle shown in Fig. 1. In addition, an auxiliary magnet coil may be attached to provide for tripping the switch from a distance, such as is required in connection with automatic limit switches on machine tools.

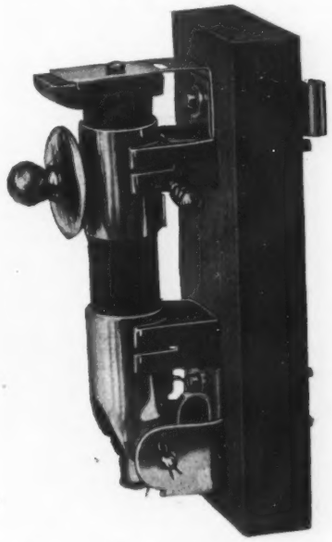


FIG. 1.—CIRCUIT-BREAKER CLOSED.

These circuit-breakers are made in four sizes; for 12½, 25, 50 and 75 amperes. Each has an operating range of from 80 to 160 per cent; that is, the tripping device may be set for any current within these per cents of the rated capacity. Adjustment is made by a knurled nut at the lower end of the arm, and may just be seen in Fig. 1. These breakers are made in single-pole types for direct current up to 250 volts and alternat-

FIG. 2.—CIRCUIT-BREAKER OPEN.

ing current up to 440 volts, and are approved by the National Board of Fire Underwriters.

The standard circuit-breaker is mounted on a porcelain base, similar to the mounting of a fuse, with all the connections on the face of the porcelain to permit being placed directly on the wall. It is also supplied for switchboard and control tablet work where the connections are made on the back, two screws being provided for mounting under these condjtions. The outfit as a whole takes up practically no more space than an enclosed fuse of the same capacity.

Laboratory Rheostat.

The illustration herewith shows a laboratory rheostat for use on direct and alternating-current circuits. It has a non-inductive resistance and a zero temperature coefficient resistance, the capacity being 56 amp on 120 volts, with ampere divisions from 0.1 amp to 56 amp in 0.1 amp steps. Each resistance with its controlling switch can be connected across the full line voltage, and being designed to carry the full amperes at such voltage, there can be no injury from overloads. Each switch is marked with the number of amperes that will flow when it only is closed, and by throwing the switches singly or in parallel any desired load is obtained. The resistance portion, which is approximately 10 in. x 12 in. x 15 in. over all, can be mounted on a side wall out of the way. The face plate or controlling portion, which is approximately 14 in. x 18 in., can be mounted on the test table, inside the cover of a desk, etc. Usually, however, the resistance portion is furnished mounted directly upon the face plate controlling portion.

LABORATORY RHEOSTAT.

The resistance elements are built up of Ward Leonard enameled resistance units. They are fireproof, strong, light and are thoroughly protected against mechanical, electrical and chemical depreciation. The rheostat is made by the Ward Leonard Electric Company, Bronxville, N. Y.

The Incompatibility of Liquid Insulating Materials.

A little understood point in connection with the use of liquid or plastic insulating materials in the manufacture and installation of electrical apparatus is the necessity of avoiding the use on the same job of different materials which are, so to speak, incompatible with each other.

There is a strong but mistaken tendency in the electrical trade to apply successive coats of different kinds of such materials on the work in hand—field winding, armature coil, or whatever the work may be. Such practice is the cause of much disappointment in the behavior of the insulating materials thus used, for the reason that many which are of good quality individually are thereby robbed of their real value. This loss of quality by intimate physical association is here termed "incompatibility," and its cause and effects among certain insulating substances are due to radical differences in their chemical and physical properties, and may be illustrated by a few examples from actual practice.

It is well known that shellac is soluble and is carried in solution by liquids of the alcohol family, paraffine by liquids of the naphtha family, and still other insulating materials by liquids of the coal-tar family. These different substances will not mix with each other, and when solutions of them are applied in successive coats as insulation on a winding or other part of a piece of electrical apparatus the result is a composite but non-homogeneous layer which will give trouble sooner or later. The two parts of the layer will not only have no affinity or adhesiveness toward each other, but will mutually repel and injure each other. Thus it is impossible to mix shellac and paraffine together and it is also impossible to produce a strong enough flux, or solvent, to make the compound homogeneous. These two different solids in suspension or solution in a plastic mass in which they are free to flow will separate in exactly the same way as liquids; and any exposure to heat—as in the ordinary use of the electrical apparatus in which the insulation is employed—will cause chemical disturbances to be set up that will eventually destroy the insulation.

An instance of this behavior of good insulating materials is in the improper use of Armalac, manufactured by the Massachusetts Chemical Company. This material is claimed to be a permanently plastic compound and when used alone is said to form a reliable insulation which remains unimpaired. Applied to the windings, leads, etc., of electrical apparatus, it will remain continuously "live" and plastic, and will afford throughout the service life of the apparatus the same dielectric strength as when first applied. But if users are inexperienced enough to contaminate it with other materials—as, for example, by dipping in shellac first and then in Armalac—the definite physical structure of the latter will be disturbed, and the material will chip and fly off, rendering the insulation of no value after a comparatively short time.

A practical case shows how a little thing, overlooked, can destroy insulation. A short time ago an officer of the Massachusetts Chemical Company received a complaint from one of the large street railway companies that Armalac was becoming brittle. Upon visiting the company's winding room and examining the machines, it was found that the bodies of the coils were in first-class condition but that the insulation of alternate leads was brittle; and that this condition was due to the fact that the winders were marking every other lead with a colored stocking, so as to keep track of the winding. An explanation of the incompatibility of the ingredients of the two products that were being used convinced the foreman of the winding department that there was a material in the stocking that was detrimental to the Armalac. Accordingly, the company abandoned the use of the stocking, which put a stop to all complaints.

It is trifling things of this kind that cause a large percentage of the insulation troubles of the present day. Users of insulating materials should not run any risk of vitiating them by permitting the careless or ill-advised employment of other compounds in conjunction with them.

Variable-Voltage Transformers.

The Moloney Electric Company, St. Louis, Mo., has placed upon the market a line of variable-voltage transformers for use in testing laboratories. Each transformer is equipped with two rotary dials, one of which increases the electromotive force in 10-volt steps, and the other varies the electromotive force in 1-volt steps. The arrangement is such that any electromotive force from 1 to 150 volts may be obtained in 1-volt steps. The transformers are designed to receive energy at 110 volts. These transformers are particularly useful in the testing of meters, motors, transformers and lamps, and should prove well adapted to central-station needs.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

While there is, of course, the customary pause in business immediately preceding a presidential election, it is proper to say that some distinct improvement has been shown in both industrial and commercial circles. The weather has been disadvantageous in so far as the drought throughout the Middle West, now partly broken, has interfered with the navigation of some of the principal streams, causing delay in the moving of crops, and has also interfered with winter wheat planting. This has caused some conservatism in farming sections, but the tone is better throughout the country and nearly every one seems to be optimistic. There has been a large movement of winter wheat to market, and this has been responsible for improvement in collections. The prevalence of the destructive forest fires in the Northwest has caused much damage and alarm, and has interfered with business in that section. The returns from the foreign trade movement for September show that in both wheat and cotton exports have been beyond the average for the season, and this of itself indicates a good trade movement. Prices in all commodities have been maintained steadily in spite of the fact that many customers are out of employment, and that the ability to buy is somewhat curtailed. The railway situation is improving steadily. The late reports show that gross earnings are coming nearer to the point of a year ago, and that the decreases are being reduced. The number of idle cars at the last report, which was made on Oct. 14, was only 101,837 as compared with 125,678 two weeks previous. This is a reduction of more than 75 per cent since the large total of April 29. The largest reduction in idle cars during the first half of October was in coal cars, which is significant in that it indicates further resumption of industrial activity. The iron and steel manufacturers are a little busier than for the past few weeks, and are receiving many inquiries. It is said that the Chicago, Milwaukee & St. Paul Railroad has placed another order for 2500 cars, and has contracted with the Battendorf Axle Company for steel underframes. The Battendorf Company will require 22,000 tons of structural steel for the car work which it has taken recently. There are many other railway orders in evidence including probably 25,000 tons of steel for bridge work in the West and many tons of light rails. The Illinois Central Railroad will take for prompt shipment 25,000 tons of steel rails. This is for reconstruction work mainly. Including the railroad work, about 65,000 tons of structural steel will be ordered soon in Chicago. Among these orders are 5200 tons for the Ritz-Carlton Hotel in New York, and 5000 tons for the new Emigrant's Industrial Savings Bank. The electrical companies have not shown great improvement in recent weeks but are operating now at something like 45 or 50 per cent of their full capacity. It is said that the three largest companies—General Electric, Westinghouse and Western Electric—are now doing an average yearly business of $94,000,000, which is to be compared with $65,000,000 at the low point last year. At the rate at which business has been taken recently by these companies it is estimated that the General Electric will do $42,000,000 worth of business, the Westinghouse $22,000,000 worth and the Western Electric $30,000,000 in the present year. It is said that the large amount of railroad and other equipment is depending upon the election of Mr. Taft, and in copper and other metal lines this condition is especially emphasized. It is believed that immediately after the election, if Mr. Taft is successful, heavy purchases of copper will be made and large construction orders will be placed. The smelting companies and metals selling companies are all prepared to rush business. General conditions are not materially changed. The cotton crop is being harvested rapidly and ginning reports are still ahead of last year. There is some evidence of preparation in wholesale and manufacturing woolen lines for large increases in business immediately after the election. In building there is still widespread activity, and the lumber mills of the South and Northwest report increased prosperity. Failures for the week ended Oct. 22, as reported by *Bradstreet's*, were 231, as against 244 for the preceding week, 220 in the corresponding week in 1907, 184 in 1906, 178 in 1905 and 180 in 1904.

THE COPPER MARKET.

Both the market for refined copper and the speculative demand for standard warrants have shown improvement during the past week. The result has been a small advance in the prices of metal with more liberal sales. The same buoyant feeling and optimistic expectancy exist in the copper market that are shown in other commerical lines. Everyone expects new business immediately after the election. Large orders for electrical material and brass products are waiting for settlement of business conditions. This fact has induced many consumers to buy during the past week, and, while their purchases have been made generally in a very guarded and conservative manner, the total has reached better figures than for any other week recently. One of the remarkable features of the present copper market is that advancing prices seem to induce buying. More metal was sold last week after quotations had been put up than during the two weeks immediately preceding at lower figures. The statistical position of copper is practically the same. Production continues at an active rate and the surplus in this country and Europe is increasing steadily. At present this accumulation is increasing more slowly than at any other time in recent months and it is predicted that within a few months the demands for consumption will make heavy inroads upon stocks. The generous sales already made for November and December delivery are expected to have this effect. One copper producer announced on Oct. 24 that the sales during the week then ending would aggregate 40,000,000 lb. in the American market, a large part of which was for export. One prominent electric concern was reported to have purchased several million pounds at a figure supposed to be 13⅜ cents or thereabouts and to have made later an offer to double the order which was declined. It is said that the United Metals Selling Company, which handles 600,000,000 lb. per year, has accepted all the orders it can fill between now and the first of the coming year. Other sellers are declining to make heavy commitments for future delivery. The general impression prevails that prices will be higher and this checks all selling pressure in the market. Exports of copper from Atlantic ports for October up to and including Oct. 26 were 17,892 tons. On that date the New York Metal Exchange again advanced prices, and quotations were:

Lake	13⅝ @ 13⅞
Electrolytic	13⅜ @ 13⅝
Castings	13⅛ @ 13⅜

The London market was as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	61	1	3	60	17	6
Standard copper, futures	61	17	6	61	15	0
Market	Firm.			Easy.		
Sales of spot	600 tons					
Sales of futures	1,000 tons					

Extreme fluctuations for this year:

	Highest.			Lowest.		
Electrolytic copper, spot	13¾			12¼		
Lake copper, spot	13⅞			12⅜		
Casting copper, spot	13½			12⅛		
London, spot	£64	5	0	£56	5	0
London, futures	64	10	0	56	17	6
London, best selected	67	10	0	60	0	0

HIGH VOLTAGE APPARATUS.—The Kelman Electric & Manufacturing Company, of Los Angeles, Cal., reports increasing orders for its high-tension oil switches and circuit-breakers. Recent orders received include the following: Los Angeles Aqueduct, 30,000-volt switches and circuit-breakers; Nevada-California Power Company, Goldfield, Nev., 50,000-volt switches; Pacific Light & Power Company, Los Angeles, Cal., 15,000-volt circuit-breakers; Arizona Power Company, Prescott, Ariz., 45,000-volt switches and circuit-breakers; Stanislaus Power Company, San Francisco, Cal., 60,000-volt switches; San Joaquin Light & Power Company, Fresno, Cal., 30,000-volt circuit-breakers; Great Western Power Company, San Francisco, Cal., 75,000-volt switches.

SPOKANE & INLAND EMPIRE RAILROAD.—Total earnings of the operation of the Spokane & Inland Empire Electric Railroad Company were $1,118,017 for the year ended June 30, 1908, an increase of $460,162 over the previous year. Operating expenses, including taxes, were $807,388, an increase of $399,076, making the net earnings for the fiscal year, $310,629, an increase of $61,085. The company's assets are $22,673,801. President Jay P. Graves, in speaking of the progress and condition of the company, says: "Work on the extension of the Inland division from Palouse to Moscow, Idaho, which was taken up in the spring, is now completed, and operation of that extension began on Sept. 15. Our power plant has been completed and two units of 5,000 hp each have been installed, and the Spokane & Inland division is now operated by power generated at our power plant. The physical condition of the properties has been kept up to a high standard. The total expenditures for the year ending June 30, 1908, for new lines and extensions, equipment and additions and betterments, has been $1,746,417, of which $333,140 was expended on power plant and $152,958 for extensions and equipment of the traction system, and the balance, $1,260,318, upon the Inland and Cœur d'Alene divisions, including their terminals. It is expected by the management that the earnings of the company will warrant the resumption of dividends on the preferred rights during the year 1909. The number of revenue passengers carried on the suburban lines was 1,096,817, and the average rate each passenger paid a mile was 1.95 cents. The number of revenue tons of freight carried was 331,594, and the average received for each ton-mile was 2.51 cents. On the city traction system lines 5,790,893 passengers were carried, with a total passenger earning of $286,476."

MUNICIPAL OPERATING COMPANY DEFEATED.—The franchise under which the Municipal Traction Company has been operating the street railway lines upon a 3-cent fare basis was defeated by a majority of 951 in the referendum vote at Cleveland, Oct. 22. The defeat of the franchise may mean that the railway property will revert to its original owners and that the old rate-of-fare strife which lasted seven years will be renewed. All banks holding Municipal Traction Company money have been notified to pay out none of it except to the Cleveland Railway Company. The franchise was defeated not so much upon the issue involved as upon the general dissatisfaction of the public toward the service given by the operating company, the service having been cut down to earn the rentals. Employees dissatisfied with the failure of their strike for better wages worked to bring about the result attained at this referendum vote. The Municipal Company will probably owe $1,000,000 when it goes out of business. On Oct. 26 a temporary receiver was asked for the Municipal Traction Company in the Federal Court, on petition of the Ingersoll-Rand Company, one of the creditors. On the same day suit was filed against the company by the Cleveland Frog & Crossing Company, which holds a claim for $21,000. One of the officials of the Municipal Traction Company says that all the property will be returned to the Cleveland Railway Company at once, provided that company will restore to the original owners the 3-cent fare lines which were taken over. The Cleveland Railway Company bought out all these lines before its property was turned over to the Municipal Company.

HUDSON TUNNELS TO COMMUNIPAW.—Mr. William G. McAdoo, president of the Hudson & Manhattan Railroad, has made the announcement that his company will build an extension from the Pennsylvania Railroad station in Jersey City to the Central Railroad of New Jersey terminal at Communipaw. The plans have been filed, but the work will not be commenced until the main line from Hoboken to the terminal building in Manhattan has been completed. Mr. McAdoo said: "The Jersey Central connection will be merely a short extension from the main lines in Jersey City. When this is done, tunnel trains can be run direct from Communipaw to the station at Newark and to Railroad Avenue in Jersey City, and thence, via the Pennsylvania station, to the Hudson terminal building in New York. This will be a great convenience, not only to the Jersey Central passengers, but also to Jersey City people who want to use the Jersey Central lines. Under existing conditions a passenger on the Jersey Central who wishes to reach Jersey City must go to Liberty Street on the ferry and then take the Pennsylvania ferry at Cortlandt Street back to Jersey City. With this extension all of the Jersey City railroad terminals will be connected with our tunnels."

16-CENT ALUMINUM ABROAD.—As a result of the increase in competition in Europe, due to the erection of aluminum works by companies outside of the international aluminum syndicate, the latter was abolished Oct. 1. The price of aluminum, which has been quite low in Europe and for some time past, has now been still further reduced and to such an extent that there is only a slight price difference between copper and aluminum. The London quotations of Oct. 9 were £64.5 to £65 per ton for electrolytic copper and £70 to £75 per ton for aluminum. This is equivalent to 16 cents per pound.

HELENA POWER & TRANSMISSION COMPANY.—The management of the Helena Power & Transmission Company, of Montana, has concluded a contract for rebuilding dam No. 2, recently destroyed by floods. The contract has been let to Stone, Webster & Company, of Boston, and will cost in the neighborhood of $800,000. The dam will be 65 ft. high from the base, and 1300 ft. long. It will back a lake 18 miles in length. The dam is located on the Missouri River at Houserlake. The dam was destroyed by the floods about April of this year, but the buildings were left intact.

PHILADELPHIA RAPID TRANSIT.—The directors of the Philadelphia Rapid Transit Company at their meeting Oct. 20 decided to convert 300 more cars into the "pay-within" type, and also to put on sale the new exchange tickets, which provide certain limitations as to their use. The new "exchanges" if not used can be redeemed for 3 cents upon presentation by the holder in person at the company's office. The cost of conversion of the cars is estimated at $150,000, or $500 per car, and it is proposed to have the company build half of the number and the J. G. Brill Company the remainder.

ELECTRIFICATION OF ILLINOIS CENTRAL.—At the annual meeting of the stockholders of the Illinois Central Railroad on Oct. 21 a resolution was adopted authorizing the directors "to proceed with all reasonable dispatch to electrify the service" on all the tracks within the city of Chicago. Four directors whose terms had expired were re-elected. Mr. James De W. Cutting, who supported Mr. Stuyvesant Fish in the Fish-Harriman fight for control, resigned as a director and Mr. John G. Shedd, president of Marshall Field & Company, was elected in his place.

DEMANDS COMMISSION ON TELEGRAMS.—The Cumberland Telephone Company, in New Orleans, has demanded from the Western Union and Postal telegraph companies a commission of 15 per cent of the tolls on messages transmitted to the telegraph offices by telephone instead of by messengers. The telegraph companies assert their right to use the telephones for any legitimate purpose, and refuse to pay the commission demanded, which makes it likely that the instruments will be removed, as was done under similar conditions in Chattanooga.

WILL MOVE HEADQUARTERS TO NEW YORK.—The Philadelphia offices of the American Gas & Electric Company, which controls the Electric Company of America, will be moved to New York on Nov. 1. The new offices will be at 30 Church Street. The company is a New York State corporation and most of its officers and directors are New York men. The company is controlled by the Electric Bond & Share Company, which, it is understood, is in turn controlled by General Electric interests.

NEW BRANCH FOR NORTHWESTERN ELEVATED.—The new branch of the Northwestern Elevated railway at Chicago, which extends from Wells Street to Cloak Street on North Water Street, will probably be opened for traffic about Dec. 1. A new terminal will be built and it is estimated that the extension will increase the company's downtown terminal capacity from 20 to 30 per cent. During the rush hours a train will be run out of the terminal every four minutes.

THE UNITED CIGARETTE MACHINE COMPANY, of Lynchburg, Va., which has used Foos engines in its power plant for eight or 10 years, has recently placed an order with the Foos Gas Engine Company, of Springfield, Ohio, for one of its 100-hp multiple-cylinder vertical engines and producer gas plant complete. This engine will be direct connected to a General Electric generator, to supply current for the operation of its magnificent new plant, which is nearing completion.

ONTARIO POWER CONTRACT.—The contract has at last been signed between the Ontario Hydro-Electric Power Commission and the F. H. McGuigan Construction Company, Toronto, which provides for the construction of a network of transmission lines for the purpose of distributing electrical energy from the commission's plant at Niagara Falls to various cities, towns and villages in the Province of Ontario. The contract price is $1,270,000 for some 290 miles of line, and is said to be the largest contract of its kind ever awarded. Toronto, Guelph, Hespeler, Waterloo, Berlin, Woodstock, Galt, London, Ingersoll, St. Mary's, St. Thomas, New Hamburg, West Toronto, Weston, East Toronto, Norwich, Walkerville and Windsor are the places to be supplied, and each one is now arranging for the purchase or construction of a distributing plant; for the commission agrees only to deliver the energy to the municipal authorities in bulk, and will not distribute it. St. Thomas will be the terminal of the transmission lines, but the government is considering the construction of another 300 miles of line, which will take in a number of other places; and F. H. McGuigan has offered to construct this additional stretch of line at the same rate per mile. Three cables, each suspended from a separate insulator, will constitute the circuit, and these circuits will be carried by some 3,200 towers. These towers, as already noted, will be 550 ft. apart except where the conditions are such that a shorter distance is necessary. The estimates call for approximately a million pounds of aluminum wire, the total mileage of cable being 1,149, not counting the ground lines or those for lightning protection. Twelve transformer houses will be required. The total height of the standard two-circuit tower will be 44½ ft. and 16 ft. square at the base. Each tower will be square, and will have four legs, each of which will be anchored in 7 ft. of concrete. The lines will be built to stand a voltage of 110,000. The towers will cost $621,000, and a double telephone line will be strung. The Ontario Iron & Steel Company, Welland, and the Canadian Bridge Company, Walkerville, Ont., will manufacture the towers, and the wire will be made at Shawinigan Falls by the Northern Aluminum Company of America.

NEWBURG (N. Y.) LIGHT, HEAT & POWER COMPANY.—The Public Service Commission, Second District, has consented to the lease by the Electric Light Company of New Paltz to the Newburgh Light, Heat & Power Company of the right to use, so far as practicable, for a term of 10 years, part of its electric pole distributing system in the village of New Paltz, and to erect a high-tension transmission line. The commission in connection with the same project has consented to the transfer by the Poughkeepsie Light, Heat & Power Company the rights of way, poles, wires, etc., and the entire construction of approximately three miles of electrical transmission line, from Marlborough and Lloyd to a point near the Poughkeepsie bridge, for $5,160. The commission has also approved the construction of a high-tension transmission line carrying 33,000 volts by the Newburgh Light, Heat & Power Company from the steam generating plant of the company through the towns of Newburgh, Marlborough and Lloyd to a point near the Poughkeepsie bridge, thence through the towns of Lloyd, New Paltz to High Falls, upon the condition that the company shall secure the consent of the municipal authorities to cross public highways. The commission has amended its order allowing the Newburgh Light, Heat & Power Company to issue bonds to the amount of $350,000, so that the proceeds shall be used as follows: For refunding its obligations, $134,450; for underground conduits, $25,000; new gas apparatus, $15,000; construction of high-tension transmission line from Newburgh to High Falls, $65,840; to purchase from the Poughkeepsie Light, Heat & Power Company the rights of way, poles, wire, etc., for $5,160; construction of substations, transformers and equipment, $25,000; for construction of transmission lines to supply electricity to the Ashokan Aqueduct contractors, $18,000, and for general construction in gas and electric departments, $41,550.

ORDERS FOR ENGINES.—The American Blower Company, of Detroit, Mich., reports a large batch of orders booked since about a month ago. Many of the orders are for important installations of heating and ventilating apparatus and forced-draft apparatus. Subjoined is a list of the contracts for A. B. C. engines: Fried & Heineman, Pittsburg, Pa., stoker equipment; Stephens Adamson Manufacturing Company, Aurora, Ill., electric light; Michigan Employment Institute for Blind, Saginaw, Mich., electric light; Westinghouse Electric & Manufacturing Company (for export), driving generator; Hiram Walker Sons, Walkerville, Can., power purposes; Fairbanks, Morse & Company, Chicago, Ill., three engines for driving generators; City of Rocky Mount, N. C., municipal electric light plant; Ault & Wiborg Company, Cincinnati, O., driving blower; Allis-Chalmers Company, Milwaukee, Wis., two engines for driving generators; Barr-Holiday Box Company, Isola, Miss., electric light plant; Isthmian Canal Commission, driving generator; Flint Body Company, Flint, Mich., electric light plant; Western Electric Company, Boston, Mass., driving generator; W. T. Osborne & Company, Kansas City, Mo., electric light plant.

ATLANTIC & SUBURBAN TRACTION COMPANY.—The property of the Atlantic & Suburban Traction Company, an electric road which extends from Atlantic City, N. J., to Pleasantville, Absecon and Somers Point, with a mileage of 18.5 miles, will be sold under the hammer in Philadelphia on Oct. 31. The company issued $250,000 refunding gold 5 per cent bonds, $500,000 first gold 5s and $27,000 car equipment bonds. The interest on all these bonds was defaulted Feb. 1, 1907, and efforts were made to induce the holders to agree to a readjustment plan, under which interest would be deferred for two years. This failing, J. L. Clawson was appointed receiver in May, 1907. The West End Trust Company, of Philadelphia, is trustee under the various mortgages. The road will undoubtedly be bought in by the bondholders.

CHICAGO SANITARY POWER.—Last week the sanitary district of Chicago entered into a 10-year contract with the town of Blue Island, Ill., for light and power on a basis of estimated returns to the district of $14,000 the first year and increases each year thereafter. The district is to take over the commercial lighting system and supply current to the inhabitants of Blue Island at a rate of 10 cents per kw-hour and pay 4 per cent interest on an $8,000 appraised valuation of the system assumed. The district has granted to Morgan Smith & Company a contract for supplying a hydraulic plant for developing 5000 more horse-power at Lockport. The contract calls for the payment of $30,200.

GENERAL ELECTRIC DOING FAIR BUSINESS.—The General Electric Company continues to operate between 55 and 60 per cent of its normal capacity, and shipments are running about $3,500,000 a month, or at the rate of $42,000,000 a year. The interests of the General Electric Company are taking a more cheerful view of the situation. Judging from inquiries received, there will be an improvement in the electrical business in the event of Taft's election.

MEXICAN MERGER INDEFINITELY POSTPONED.—The negotiations which have been pending for some months looking to the absorption or leasing of the Mexican Power & Light Company by the Mexican Tramways Company have been indefinitely postponed. It is said that the Mexican Power & Light Company will adopt some other financing plan for paying off its floating debt.

Financial Intelligence.

THE WEEK IN WALL STREET.

While trading was only a little more active and price changes were unimportant in the Wall Street market during the week ended Oct. 26, there was an unmistakably cheerful sentiment and a general clearing of decks for prosperity which is believed to be at the threshold. The depressing element of European selling was not in evidence to any extent although some uneasiness is still felt in foreign exchanges over the situation in the Balkans. This did not disturb Wall Street to any extent and in no way interfered with the bouyant tone developed by the political situation at home. Just what has developed the feeling of confidence in the election of Mr. Taft it is difficult to say, but there is no doubt of its genuineness. The campaign has been one of remarkable apathy. Only one little flurry could by any reasonable excuse be attributed to politics and that was so temporary that it would be hardly correct to call it a political scare. Even in the brief periods where profit takers caused temporary reactions in prices, there was always plenty of support. There were generally more buyers than sellers for stocks, and there was always an eager demand for good bonds. The public is not trading in stocks in large amounts, but there seem to be at all times plenty of

investors ready to take bonds. Signs of improved trade conditions during the last week were many. From all sides came reports of inquiries and conditional orders that will be made actual transactions if Mr. Taft is elected. The railroads, especially, are waiting for the election to be over. The careful economy which they have observed during the period of depression has left many in need of equipment. Orders from the railways are expected to be liberal and, in many cases, urgent, for rolling stock, machinery and rails. As it is calculated that at least one fourth of the traffic of the railroads comes from handling materials for other roads, this business in itself will do much to bring gross earnings back to a normal basis. Some roads have already begun to order equipment and others have announced that they will soon be in the market. The leaders in the market have been the same issues that have been prominent since the professional traders began putting up prices last spring. Union Pacific, Reading, steel common and Southern Pacific have been the most active. All have shown some advance, and all are far above the figures of a year ago. The money market has continued to be very easy with little demand either in this country or Europe. As the end of October usually marks the termination of the crop moving demand from the West, which was phenomenally light this year, there is no reason to anticipate any hardening of rates until after business reaches normal proportions. Rates quoted on Oct. 26 for call loans were 1¼ @ 1½ per cent, and for 90-day funds, 3 per cent. The prices quoted in the table are those of the close Oct. 26.

NEW YORK.

	Oct. 19.	Oct. 26.	Shares sold.		Oct. 19.	Oct. 26.	Shares sold.
All.-Ch.	11⅝	11⅜	1,600	Int.-Met., pfd.	29¼	29	9,000
All.-Ch., pfd.	35⅞*	37	4,000	Mackay Cos.	73¾	73½	800
Amal. Cop.	75¼	80¼	174,410	Mackay Cos., pfd.	69¾	20	900
Am. D. T.	35*	35*	——	Manhattan Elev.	137	137½	340
Am. Loc.	49	50	11,410	Met. St. Ry.	28*	28*	——
Am. Loc., pfd.	105*	105*	——	N.Y.&N.J. Tel.	117	116	40
Am. Tel. & Cbl.	71*	71*	——	Steel, com.	46¼	48	255,852
Am. T. & T.	127	127	6,800	Steel, pfd.	108⅞	110½	24,250
B. R. T.	48¼	49¼	24,990	W. U. T.	58½	60¼	3,779
Gen. Elec.	144½	144	2,100	West'h, com.	82	82¾	13,290
Int.-Met., com.	10¼	9⅞	5,458	West'h, pfd.	100	99½	200

PHILADELPHIA.

	Oct. 19.	Oct. 26.	Shares sold.		Oct. 19.	Oct. 26.	Shares sold.
Am. Rys.	44½	44½	——	Phila. Elec.	11	11*	——
Elec. Co. of A.	9⅞*	9⅞*	——	Phila. R. T.	23	22¾	——
Elec. Stor. B'ty	35½	36¼*	——	Phila. Traction.	90	90*	——
E. S. B'ty, pfd.	49	49*	——	Union Traction.	—	51¾	——

CHICAGO.

	Oct. 19.	Oct. 26.	Shares sold.		Oct. 19.	Oct. 26.	Shares sold.
Chi. City Ry.	176*	176*	——	Chi. Tel. Co.	124	124	——
Chi. Rys., Ser. 1.	104½	104½*	——	Met. El., com.	12¾*	12¾*	——
Chi. Rys., Ser. 2	42½	45	——	Nat'nal Carbon.	69*	69*	——
Com. Edison.	109¼	108¼	——	Nat. Carb., pfd.	109*	110¼	——
Chi. Subway.	19*	19½	——				

BOSTON.

	Oct. 19.	Oct. 26.	Shares sold.		Oct. 19.	Oct. 26.	Shares sold.
Am. Tel. & Tel.	127¼	127	——	Mass. E. R., pfd.	51*	51*	——
Com'bind Tel.	122	122*	——	Mex. Tel., pfd.	6*	6*	——
Gen. Elec.	145	145	——	N. E. Tel'p.	122	121	——
Edison El. Ill.	230*	240	——	W. Tel. & Tel.	8*	8*	——
Mass. Elec. Ry.	10*	10*	——	W. T. & T., pfd.	75	75*	——

*Last price quoted.
Shares sold are for week Oct. 19 to Oct. 24.

DIVIDENDS.

American District Telegraph Company of New York, semi-annual, 1 per cent, payable Nov. 15.

Montreal Light, Heat & Power Company, quarterly, 1½ per cent, payable Nov. 16.

Mexico Tramways Company, quarterly, 1 per cent, payable Nov. 1.

Ohio Traction Company (Cincinnati, Ohio), preferred, quarterly 1¼ per cent, payable Nov. 2.

INTERSTATE RAILWAYS COMPANY REORGANIZATION.—While the plans for the reorganization of the Interstate Railways Company, of Philadelphia, have not been made public, it is understood that a new holding company is to be formed to take over the properties of the present company, which will pass out of existence following the default on Feb. 1, next, of the interest on the $10,000,000 of collateral trust bonds and the subsequent sale of the collateral at foreclosure. This collateral consists mainly of the stock of the United Power & Transportation Company, the operating company, which will be bought in by the new holding company. The new company will then issue sufficient preferred stock to provide for all necessary improvements and extensions, and to take up the outstanding Interstate collateral trust 4 per cent bonds. The $2,500,000 Interstate company stock may also be taken care of in some manner. Common stock for the new company may be issued for this purpose. The reorganization will provide about $2,000,000 cash to be obtained from the sale of the preferred stock. The collateral trust bonds of the United Power & Transportation Company will not be disturbed in the reorganization, nor will the latter company be affected in any way by the readjustment, which involves the securities only of the present holding company.

KINGS COUNTY ELECTRIC.—The official report of the Kings County Electric Light & Power Company for the quarter ended Sept. 30 and also for the nine months ended that date show very substantial gains in both gross and net over the reports of last year. While maintaining an increase in gross business of 6½ per cent in comparison with the previous year, when times were exceedingly prosperous, the company has effected radical economies, the operating expenses being 3½ per cent less than the previous year, making a gain of 18 per cent in net earnings over operating expenses. The depreciation charges have been increased by more than 70 per cent, but it should be borne in mind that this does not represent money spent, but only earnings set aside as a reserve against which replacements are charged, as they take the place of depreciated or abandoned property. The credit to this fund, after deducting actual expenditures, is now in excess of $500,000. Notwithstanding this very large increase in depreciation charges, however, the earnings of the company, after deducting fixed charges for bond interest, show an increase of more than 14 per cent over last year, and after deducting the dividend for the quarter still show a surplus of $7,460, as compared with a deficit of $18,357 for the same quarter of 1907.

GEORGIA RAILWAY & ELECTRIC COMPANY.—For the eight months ended Aug. 31, the gross earnings of the Georgia Railway & Electric Company were $2,145,189, a slight increase over the same period in 1907. The net earnings will also show a slight increase, indicating that the company in the full year will equal the record of 1907, in which it earned 8.7 per cent on the $8,514,600 of common stock outstanding, after paying 5 per cent on the preferred. Georgia Railway & Electric Company has outstanding $22,314,600 of capitalization, of which $11,400,000 is bonds. The company controls the entire street railway, electric light, power and steam heating field in and about Atlanta. The property was originally financed entirely in the North, and principally in New England. The New England interest is still very considerable, but the local market for the securities has been steadily broadening, with the result that the company has several hundred shareholders in Atlanta.

WESTINGHOUSE READJUSTMENT REPORT POSTPONED.—The readjustment committee of the Westinghouse Electric & Manufacturing Company met Oct. 27 to receive the reports of the subcommittees which had been seeking subscriptions to the new assenting stock under the merchandise creditors' plan. No reports were received nor action taken looking toward the ratification of the plan. It was decided to adjourn until after the election. Mr. Albert Stickney, Jr., secretary of the committee, refused to give out information as to the date of the next meeting. It is understood that practically all of the bank creditors have accepted the plan and that arrangements have been made to take up the deficiency in stockholders' subscriptions.

CONNEAUT (OHIO) & ERIE TRACTION COMPANY.—Robert W. Watson, receiver of the Conneaut & Erie Traction Company, has made application to the United States Circuit Court at Erie, Pa., for permission to issue $20,000 receivers' certificates, of which $15,000 is to pay for roadbed and track improvements, and $5,000 as compensation for his services from Sept. 4, 1907, to Sept. 4, 1908. These certificates are to be a first lien on all property and franchises of the company. The court has appointed Dec. 1 for hearing the petition.

NORTHERN CALIFORNIA POWER COMPANY.—It has been announced that an issue of $10,000,000 5 per cent bonds is contemplated by the consolidated Northern California Power Company. These will be used to retire the present bonded indebtedness of various subsidiary companies and provide funds for extension. These include the Northern California Power Company, which has a capital stock of $10,000,000. The shareholders meet on Nov. 11 to vote the bonded indebtedness.

INTERBOROUGH MAY BUILD MONO-RAILROAD.—Application has been made to the Public Service Commission by the Interborough Rapid Transit Company for permission to construct a mono-railroad in place of the present horse car line from Bartow station on the branch line of the New York, New Haven & Hartford Railroad to City Island. The commission will probably grant the permission, unless its engineers find some serious defect in the plan. If the line is to be built it will be ready for operation next spring. The car to be used is the one invented by Mr. Howard H. Tunis, of Baltimore. It is claimed that the car is capable of high speed without oscillation and that 80 miles an hour is attained. Mr. John H. Starin, who was formerly vice-president of the Rapid Transit Commission, is interested in the Monoroad Construction Company, which is supporting the present undertaking. The Tunis car is 50 ft. long, 6½ ft. wide, and pointed at each end. It has four wheels, which are placed tandem under the car, each wheel having a double flange. These wheels run over a single rail. Above the car at each end is a flexible arm connected with an X-shaped overhead truck. Each truck consists of four guide wheels, which run on an L-shaped overrail, so arranged that the guide wheels cannot leave the overhead rail without something breaking. These guide rails conduct the electricity to the motors, as the trolley wheels do on ordinary cars.

RECEIVER ASKED FOR LOUISVILLE & EASTERN.—Application has been made before Judge Walter Evans, of the United States District Court at Louisville, Ky., for the appointment of a receiver for the Louisville & Eastern Railroad Company, which now operates 27 miles of interurban electric railroad between Louisville and La Grange, Ky. The company has under construction a 23-mile branch to Shelbyville and the present litigation arises out of the steps taken to finance this extension. The president of the company is Mr. F. M. Fauvre and the treasurer, Mr. C. Edgar Elliott, both of Indianapolis. It is stated that holders of the first mortgage bonds will seek a reorganization. The company's property is mortgaged to the Old Colony Trust Company, of Boston, under an indenture authorizing $2,000,000 bonds, of which only $650,000 have been issued, covering the line now in operation. These bonds were sold chiefly in Boston and Philadelphia. Interest on these bonds was due and promptly paid on Oct. 1, and it is stated that the road from Louisville to La Grange is earning enough to meet the interest not only on the bonds outstanding, but also on those issuable against the new construction as well. The bondholders have asked the appointment of the United States Trust Company, of Louisville, as receiver.

MAY RETIRE PHILADELPHIA TRACTION BONDS.—A special meeting of the Philadelphia Traction stockholders will be held Oct. 29. A circular to the stockholders says: "It is not improbable that in working out the details of the new loan, provision will be made for the immediate or ultimate retirement of the balance of the issue of 4 per cent collateral bonds negotiated by your company in 1887, thus relieving your company of its obligations with respect to the same." This loan was originally $1,300,000, but has been reduced to $455,000 by sinking fund drawings at 105. The issue is secured by the deposit of 5100 shares of West Philadelphia Passenger Railway and 1750 shares of Union Passenger Railway stock, and the Rapid Transit Company desires to use these securities in negotiating its $5,000,000 loan.

E. H. HARRIMAN AND WESTINGHOUSE.—Reports that have been current in Wall Street that Mr. E. H. Harriman has become deeply interested in the Westinghouse Electric & Manufacturing Company cannot be confirmed. Such interest, if it exists, would, probably, not be for Mr. Harriman's individual account—but rather for railway corporations in which he is interested, which are about to adopt comprehensive electrification plans. The Erie is credited with contemplating an electrical expenditure of $14,000,000. The Illinois Central will spend still more. Southern Pacific about Los Angeles can spend approximately $5,000,000.

LONDON UNDERGROUND EARNINGS INCREASE.—Reports of earnings of the Underground Electric Railways Company, of London, in which there are many American security holders, show an excellent increase. For the week ended Oct. 10 the total earnings were £28,663, an increase of £4,274 over the same week last year. The earnings for 15 weeks were £420,018, an increase of £59,255.

BIG POWER COMPANY INCORPORATED IN MINNESOTA.—The Minnesota & Ontario Power Company has been incorporated under the laws of Minnesota with a capitalization of $7,000,000. The company announces that it is the intention "to develop the idle water power of the section, and to establish a paper manufacturing center and conduct lumbering operations over a territory of 150,000 square miles."

REPORTS OF EARNINGS.

	Gross Earnings.	Operating Expenses.	Net Earnings.	Charges.	Surplus.
Montgomery (Ala.) Light & Power Company:					
Year ended June 30, 1908	$320,375	$151,508	$168,867	$103,194	$65,673
Year ended June 30, 1907	294,267	130,090	164,177	103,194	60,983
Montreal Street Railway Company:					
Year ended Sept. 30, 1908	3,677,432	2,158,394	1,519,038	454,638	1,136,411
Year ended Sept. 30, 1907	3,503,643	2,104,653	1,398,990	413,773	1,040,357
Little Rock Railway & Electric Company:					
September, 1908	54,655	27,340	27,315	10,605	10,710
September, 1907	57,019	26,753	30,266	8,674	21,592
Kings County Electric Light & Power Company:					
July 1 to Sept. 30, 1908	898,659	431,219	467,440	151,640	207,460
July 1 to Sept. 30, 1907	843,376	446,895	396,481	151,640	181,643
American Light & Traction Company:					
Nine months ended Sept. 30, 1908	1,851,805	36,000	1,815,805	.....	325,200
Nine months ended Sept. 30, 1907	1,696,134	33,000	1,663,134	.....	230,675
Albany & Hudson Railroad Company:					
Year ended June 30, 1908	230,096	168,277	61,819	125,986	*13,310
Year ended June 30, 1907	221,468	161,774	59,694	108,597	3,625
Memphis Street Railway Company:					
September, 1908	143,044	88,971	54,073	35,532	18,541
September, 1907	140,902	83,663	57,239	34,435	22,304
Birmingham (Ala.) Railway, Light & Power Company:					
September, 1908	177,891	122,266	55,625	43,617	12,008
September, 1907	198,578	126,827	71,751	42,388	29,363
Aurora, Elgin & Chicago Railway Company:					
Year ended June 30, 1908	1,401,107	766,977	634,130	334,408	299,722
Year ended June 30, 1907	1,331,985	722,280	609,705	319,100	290,605
Fonda (N. Y.), Johnstown & Gloversville Railroad Company:					
July 1 to Sept. 30, 1908	231,827	100,206	131,621	.....	.....
July 1 to Sept. 30, 1907	264,233	118,101	146,132	.....	.....

*Decrease.

GENERAL NEWS

Construction News.

ALBERTVILLE, ALA.—Bids will be received until Nov. 1 by the Sand Mountain Electric Company for supplies for an electric light plant of 15 arc and 600 incandescent lamps. Steam plant and generator have been purchased.

BIRMINGHAM, ALA.—The City Council has directed the Southern Bell Telephone Company, the People's Telephone Company and the Birmingham Railway, Light & Power Company to place their wires underground in certain sections of the city.

ELBA, ALA.—The Pea River Power Company is making arrangements to rebuild its power house, which was recently destroyed by fire. Dr. H. D. Boyd is general manager.

MONTGOMERY, ALA.—The D. P. West ice and power plant has been purchased by C. E. White, Boston, Mass., who proposes to organize a company and improve the plant.

HEBER, ARK.—The City Council has granted a franchise to C. F. Crosby to construct and operate a street railway in Heber.

ANGELS CAMP, CAL.—It is reported that John C. Benson is negotiating with the Tuolumne County Water & Electric Power Company, of Sonora, Cal., to furnish electrical energy to operate his mines, which are located about three miles from Angels Camp.

COLFAX, CAL.—It is reported that John Butler is planning to purchase the local exchange and telephone lines of the Pacific Telephone & Telegraph Company in Colfax.

FOREST HILL, CAL.—C. W. and M. C. Longstaff, owners of the local electric light plant, have purchased the Forest Hill telephone exchange and lines of the Pacific Telephone & Telegraph Company. The new owners are making arrangements to extend the telephone lines to all the mines on the divide.

FRESNO, CAL.—The Fresno Traction Company is planning extension to its system in Fresno, which will include the building of three or four miles of track. A. C. Wilshon is general manager.

GREENVILLE, CAL.—Arrangements are being made to establish an electric light plant in Greenville, machinery for which, it is said, will be ordered at once. The company will operate under the name of the Indian Valley Electric Light & Power Company, and will furnish electrical service in Greenville and Indian Valley. O. C. Pratt is interested in the enterprise.

HEALDSBURG, CAL.—Plans are being considered for enlarging the municipal electric light plant and water works system, for which surveys are now being made. It is proposed to construct an auxiliary pipe line of 2800 ft., which it is said will furnish sufficient power to double the present output of the plant.

LEMOORE, CAL.—The City Trustees have decided to hold an election to vote on the proposition of issuing $25,000 in bonds for improvements to the municipal electric light plant and water works system.

MODESTO, CAL.—The County Commissioners have granted Eugene McCabe permission to erect a telephone line on the county road running south from the Paradise Road to the Tuolumne City Bridge and a short distance beyond.

MODESTO, CAL.—The La Grange Dredging & Power Company, which recently secured a franchise to furnish electricity in Turlock, will commence work at once on the construction of a dam on the Tuolumne River. The transmission line to Turlock is to be completed within four months and will be followed by the extension of transmission lines to Modesto and other places in the San Joaquin Valley. The company is also planning to construct electric railways in this part of the valley from the Sierras to the Coast Range. E. A. Wiltsee and John Hays Hammond, of New York, N. Y., are interested in the enterprise.

ROSEVILLE, CAL.—Extensive improvements are being made to the quarry owned by Mr. Pernu, which will include electrical apparatus for operating the entire plant.

SACRAMENTO, CAL.—Judge J. A. Waymire, of Alameda, Cal., is interested in a propect for supplying the bay cities and intermediate points, including Sacramento, with water from Lake Tahoe, the Truckee River and North Fork of the American River. It is proposed to divert water from the Truckee River four miles below Lake Tahoe, carrying it in a concrete canal to Squaw Creek Valley, thence tunneling five miles and a half through the mountains to Soda Springs, at the head of the American River, thence by canal and pipe to the North Fork of the American and to Dutch Ravine, near Newcastle, from which point the water would be piped to the bay, a distance of 120 miles. It is estimated that 300,000 hp of electrical energy could be generated along the route. The cost of the entire work is estimated at $20,000,000.

SALINAS, CAL.—The Monterey County Gas & Electric Company contemplates increasing the output of its local electric plant, using machinery discarded at the Monterey plant. F. J. Southerland is general superintendent.

SAN DIEGO, CAL.—Arrangements have been completed by the Pacific Telephone & Telegraph Company to erect a new toll line between Escondido and San Diego, work on which will begin in a short time.

SAN FRANCISCO, CAL.—Charles Murphy, of San Francisco, Cal., has applied to the Board of Supervisors for an electric railway franchise to include practically all the towns of Southern Marin.

DENVER, COL.—The Denver City Tramway Company will extend its street car system to Valverde, Overland Park and Fort Logan Districts. The company also plans to construct a new substation, the equipment of which will include two 500-kw rotary converters. John Evans is chief engineer.

WASHINGTON, D. C.—The Washington, Arlington & Falls Church Railway Company has filed a mortgage on all of its property to secure an issue of $1,000,000 in bonds. The Girard Trust Company, of Philadelphia, Pa., is trustee under the mortgage.

JASPER, FLA.—The Jasper Water & Light Company is considering the question of installing another dynamo in its plant. W. A. Smith is manager.

LIVE OAK, FLA.—The construction of a large power plant on Suwannee River, near White Springs, Fla., is under consideration by the Suwannee River Railway & Power Company, represented by D. G. Zeigler, of Atlanta, Ga., and Jasper R. Walker, of White Springs, Fla. The company is to be capitalized at $3,000,000 and it proposes to construct and operate a railway and power plant and to build electric railways to Jacksonville, Fernandina, Valdosta, Tifton and other cities in Florida and Georgia. It is estimated that 25,000 hp can be developed at a cost of about $475,000.

SARASOTA, FLA.—The City Council has granted H. P. Porter, of Sarasota, a franchise to operate an electric light system in this city.

DAWSON, GA.—The Dawson Telephone Company has made application for a charter, and has also petitioned the City Council for a franchise to construct a telephone system in Dawson. The directors are: J. H. Davis, W. A. Davidson, J. A. Gibson and others.

MENLO, GA.—The Menlo Mineral Springs Company is in the market for a lighting plant for an amusement resort and would like to receive estimates on the same.

FRASER, IDAHO.—The Fraser Telephone Company, which was recently incorporated, is planning to take over the telephone line between Fraser and Greer, and erect about 20 miles of new line.

STITES, IDAHO.—The Stites-Elk Telephone Company is repairing and putting in order the telephone line between Stites and Elk City; also between Elk City and Oro Grande, which were recently puchased by the company, and is also making arrangements to construct a telephone line to Dixie.

WALLACE, IDAHO.—Work will soon commence by the Washington Water Power Company on the construction of a high-tension transmission line, 30 miles in length, from Caraldo to Wallace and vicinity, which will connect the power station at Post Falls with the Cœur d'Alene mining district.

WALLACE, IDAHO.—Application has been made to the City Council by Jesse Freeman, representing a syndicate of Wallace men, for a franchise to operate an electrical light and power system in Wallace for a term of 50 years. A site for a power plant has been located on Slate Creek, where it is estimated that 15,000 hp can be developed. The transmission line, which will be about 15 miles in length, and the plant will involve an expenditure of about $1,250,000. William Stites, Thomas McGowen, D. L. Hopkins and George Baldwin, with Mr. Freeman, are interested in the project.

WARDNER, IDAHO.—Work will soon be resumed on the Corrigan Mine, owned by the Federal company, which will be operated by electricity. A new 20-drill compressor and electric motor and an electric pump on the 300-ft. level will be installed. Electrical energy for operating the machinery will be furnished by the Washington Water Power Company, which is now erecting a transmission line for that purpose.

CHICAGO, ILL.—The stockholders of the Central Illinois Railroad Company have authorized that all tracks of the railroad operating within the limits of the city of Chicago are to be equipped to be operated by electricity.

DAHLGREN, ILL.—The capital stock of the Dahlgren People's Telephone Company has been increased from $12,500 to $20,000.

TAYLORVILLE, ILL.—The Taylorville Street Railway Company has awarded a contract for the construction of its street railway and overhead equipment, which will involve an expenditure of about $61,800. The company is erecting a power house in this city, which will soon be completed and for which contracts for machinery will be awarded. The railway will be about 4 miles in length. W. B. Adams is president.

WOODSTOCK, ILL.—Plans are being considered to install a 400-kw direct-connected unit in the municipal electric light plant. T. B. Swale is manager.

COLUMBIA CITY, IND.—Extensive improvements are contemplated by the Whitley Telephone Company to its plants in this city and at South Whitley next spring. William Pogue is general manager.

EVANSVILLE, IND.—The Evansville & Southern Indiana Traction Company has decided to commence work on the construction of the extension of its system from Patoka to Terre Haute, and also to make improvements to its power house in Evansville, which will involve an expenditure of $10,000.

GOSHEN, IND.—By a ruling of Judge Dodge in the injunction case to prevent the Mayor and City Council in carrying out a contract with R. N. Ashe to install a new electric light plant in the city, the contract will have to be ratified by a vote of the people. The statute limiting a city's debt is involved in the controversy.

LOGANSPORT, IND.—Washington and Carrollton Townships have voted a subsidy of $20,000 in aid of the construction of the Logansport, Frankfort & Indianapolis Traction Company's railway.

ALBIA, IA.—The Albia Interurban Railway Company is extending its system to Hiteman, a distance of 6 miles. The Enginering Construction & Securities Company, of Chicago, Ill., is financing and building the extension. The contract with the railway also includes the purchase of the plant and holdings of the Albia Electric Light & Power Company and remodeling the same.

CLIO, IA.—A telephone company has been formed in Clio and will establish a central exchange in this city. The officers are: J. Lewis, president; Homer Fernel, secretary, and Carl Glaus, treasurer.

DUNLAP, IA.—The contract for the construction of the telephone building in Dunlap was awarded to J. N. Roberts for $2,500.

GALVA, IA.—The Galva Telephone Company has increased its capital stock to $25,000.

KEOKUK, IA.—The electric plant of the Keokuk Electric Railway & Power Company was badly damaged Oct. 20 by the bursting of a flywheel at the power plant, leaving the towns of Keokuk, Hamilton and Warsaw without electric and street car service.

SUMNER, IA.—The E. A. Hermane Telephone Company is contemplating the construction of a telephone line to Oelwein and Waverly.

ELLINWOOD, KAN.—The contract for construction of the municipal electric light plant has been awarded to the Mathews Electric Company, Kansas City, Mo., for $33,700. The W. K. Palmer Company, 718 Dwight Building, Kansas City, Mo., has charge of the engineering work.

ELLIS, KAN.—An election will be held Nov. 11 to vote on the proposition to issue bonds for the construction of an electric light plant and water works system. The W. K. Palmer Company, Dwight Building, Kansas City, Mo., consulting engineer, has been engaged to prepare plans and take charge of the work.

McPHERSON, KAN.—Plans are being considered for improving and increasing the output of the plant of the McPherson Water & Electric Works, which will include the installation of a new engine and alternating-current generator. John T. Salthouse is manager.

THIBODAUX, LA.—The Council is considering the question of issuing bonds for the purpose of making improvements to the municipal electric light plant.

ST. BERNARD, LA.—The St. Bernard Rendering & Fertilizing Company, at Florida Walk, has awarded a contract to the Commercial Electric Company of New Orleans, La., to install an electric plant at its works. The shell-road from Claude Street to the plant will be lighted by electricity. A contract has also been awarded by the St. Bernard Oil Refining Company, at Merauxville, to the Commercial Electric Company to install an electric lighting plant at its factory.

BOSTON, MASS.—The building at the lower lock in the new Charles River Dam, in which machinery will be placed for operating the drawbridge and locks, is nearly completed. The equipment will include two 50-hp motors, electricity for which will be supplied by the Boston elevated and electric light companies.

CLINTON, MASS.—The municipal electric lighting committee has secured the services of J. H. Vail, electrical engineer, to determine the value of the electric and gas plants owned by the Clinton Gas Company, which will be taken over by the town, if it decides to establish a municipal lighting system.

FALL RIVER, MASS.—Announcement has been made by the Fall River Electric Light Company of a reduction of 20 per cent in the rate for electricity for lamps, beginning Nov. 1, when the present charge of 15 cents per kw-hour will be reduced to 12 cents per kw-hour, with still further reductions for quantity, and a discount of 10 per cent for payment of bills on or before the 15th of the month.

MAYNARD, MASS.—The State Railroad Commission has authorized the Lowell, Acton & Maynard Street Railway Company to issue $25,000 additional capital stock, to be offered to stockholders at $100 per share, the proceeds to be used for extensions.

STOCKBRIDGE, MASS.—The Stockbridge Lighting Company has voted to petition the State Board of Gas and Electric Light Commissioners for authority to increase the capital stock from $25,000 to $40,000 for the purpose of paying the debt incurred in building a street lighting system and the extension of lines. This system was installed during the summer, combining overhead and underground lines, equipped with series tungsten lamps of 32 cp. No further extensions are proposed. The company reports the results fairly satisfactory for its first year of business, with good prospects for increased revenues in 1909. Allen T. Treadway is president and Charles T. Hull, treasurer.

CHESANING, MICH.—The business men of this town have organized a Home Telephone Company and propose to install and operate a telephone system.

GRAND LEDGE, MICH.—The Common Council is reported to be considering the question of abandoning the municipal electric lighting plant and to purchase electrical energy from the Commonwealth Power Company, of Kalamazoo, Mich.

LUDINGTON, MICH.—Surveys are being made along the Pere Marquette River with a view of developing the water power to generate electricity. The site for the proposed dam is located at Duck Point in Custer Township. It is estimated that about 1400 hp can be developed. A. P. Carr and E. J. Quirk are interested in the project.

LUDINGTON, MICH.—In consideration of certain concessions in the question of water rights Schoonberger & Company have agreed to build a reinforced steel and concrete dam just below the site of the old dam in Hamlin Lake. They agree to construct a fish ladder in accordance with specifications made by the United States Government and an electric generating plant, transmission lines, etc. The plans call for an expenditure of about $40,000. For further information address Schoonberger & Company, care Cartier Lumber Company, Ludington, Mich.

DEER RIVER, MINN.—The Everton Electrical Light Company, which was recently granted a franchise to install an electric light plant, is making arrangements to commence work on construction of its plant, the cost of which is estimated at $10,000. Machinery for the plant has already been purchased. W. A. Everton is manager and Thomas Reece is engineer in charge of the work.

INTERNATIONAL FALLS, MINN.—The Rainy River Improvement Company, which is developing the water power at Koochiching Falls, has succeeded in floating bonds to the amount of $3,000,000, with the privilege of securing $5,000,000, if necessary. Contracts for the construction of the dam have been awarded to J. G. White & Company, of New York, N. Y.

MAHNOMEN, MINN.—A. O. Vachon, village recorder, would like to receive propositions for the construction of a municipal electric light plant.

REDWOOD, MINN.—A. C. Burmeister, president of the Redwood Falls Milling Company, has been granted a 15-year franchise to operate an electric light, heat and power plant. It is expected that the water power of the company will be developed to its full capacity.

ST. CLOUD, MINN.—Arrangements are being made to make improvements to the St. Cloud Woolen Mills, which will include the installation of new looms, a new dynamo, heating and lighting equipment, the cost of which is estimated at about $15,000.

TWIN VALLEY, MINN.—The Faith Telephone Company is making arrangements to rebuild its telephone lines to Mahnomen and Waubun and improve the service.

KIRKWOOD, MO.—The question of holding an election to vote on the proposition of issuing $15,000 in bonds for a municipal electric light plant is under consideration.

MOBERLY, MO.—The Wabash Railroad Company has installed an electric power plant at Moberly, which will furnish electricity to operate the foundries, washout plant, turntable, coal elevator and pumping plant, and also for lighting the offices, station and shops at this place.

MILES CITY, MONT.—The General Electric Company, of Schenectady, N. Y., has been awarded the contract for extension to the municipal electric light plant.

MISSOULA, MONT.—Plans are being considered by the Rocky Mountain Telephone Company for extensive additions to the Missoula telephone system, which include the installation of additional switchboards and circuits. The company is also planning to extend its toll lines to Stevensville and Hamilton.

BEATRICE, NEB.—The Holmesville Mill & Power Company, recently incorporated, is building a new dam on Blue River, near Holmesville. The entire plant will be thoroughly overhauled and remodeled. G. W. and J. H. Steinmeyer are interested in the enterprise.

OMAHA, NEB.—The Nebraska Traction & Power Company has awarded a contract to the General Construction Company, of Omaha, Neb., for the construction of its proposed electric railway from Omaha to South Omaha, Ralston and Papillion, Neb., a distance of 6½ miles, including a telephone plant. The company proposes to install overhead catenary construction and will erect its power station and repair shops at Ralston. Electricity for lamps and motors will be furnished to towns along the route. M. Uhl is president and R. H. Oliver is superintendent and chief engineer.

TALMAGE, NEB.—At an election held Oct. 20 the citizens voted against the proposition to issue bonds to construct an electric light plant. John Norton is clerk.

WINNEMUCCA, NEV.—The Board of County Commissioners has granted the Golconda Telephone & Power Company a franchise to operate its system in Goldrun Township. J. E. Webb is president of the company and A. G. Mollin treasurer, both of Golconda.

HOLMDEL, N. J.—The Hudson & Middlesex Telephone & Telegraph Company has been granted a franchise by the Holmdel Township Committee to build a trunk line from what is known as the "Old Woman's

Bridge" to Everett, by the way of Holmdel. The company has also applied for a franchise to erect telephone wires on all the roads in the township.

ATLANTIC CITY, N. J.—Plans are being made by the Atlantic City & Shore Railroad Company for the construction of an electric railway to run the entire length of Arkansas Avenue from the meadow to the beach.

AUBURN, N. Y.—The International Harvester Company has entered into a contract with the Auburn Heat, Light & Power Company, under the terms of which the latter company is to furnish electricity to operate No. 1 of the plants of the International Harvester Company at Genesee and Mechanic Streets, where steam power will be discarded and electric motors with a rating of 850 hp will be installed. Electricity for operating the plant will be furnished from the State Street and North Street power houses, supplemented by Niagara power. The motors will be installed by the Harvester company, the power company furnishing electrical energy only. F. L. Stevenson is chief electrical engineer of the International Harvester Company.

BATH, N. Y.—The Citizens' Electric Service Company is in the market for two gas engines, bids for which will be received by the Tower Engineering Company, 226 Ohio Street, Buffalo, N. Y.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has filed an amendment to its charter increasing the capital stock of the company from $650,000 to $700,000.

BUFFALO, N. Y.—The committee on laws and legislation of the Board of Supervisors has rejected the proposition of the General Electric Company to furnish electricity at the rate of 6 cents per kw-hour for lighting the Seventy-fourth Regiment Armory, and will report in favor of installing a gas engine to generate electrical energy required for the building. Bids ranging from $6,400 to $8,600 have been submitted for installing the plant.

CHITTENANGO, N. Y.—De Witt C. Hadcock is promoting a project to construct an electric railway to connect Chittenango with the West Shore Railroad, which will be 2½ miles in length. It is proposed to organize a company to be capitalized at $50,000 to build the road, work on which will probably begin next spring.

CORINTH, N. Y.—The Corinth Light & Power Company has applied to the Public Service Commission for permission to issue $25,000 in capital stock.

HUDSON, N. Y.—The contract for the construction of the new boiler house of the Albany & Hudson Railroad Company, at Stuyvesant Falls, has been awarded to Thomas Brennan, of Hudson. It is said that bids are now being received for new machinery for the plant. The cost of the work is estimated at $75,000. Raymond H. Smith is manager.

INWOOD, N. Y.—The Town Board of Hempstead has approved the petition of the local taxpayers for the creation of a local lighting district in this village. A committee has been appointed to recommend at what points the lamps are to be erected.

NEW YORK, N. Y.—Announcement has been made that the Hudson & Manhattan Railroad Company will extend its lines to the New Jersey Central terminal in Communipaw by the way of a spur from the main line in Railroad Avenue.

ONEIDA, N. Y.—D. C. Hadcock is interested in a project to construct an electric railway from Rome to the State Custodial Asylum, a distance of two miles. A company will soon be organized with a capital stock of $25,000. It is planned to eventually extend the railway to Oneida Castle, a distance of 13 miles.

OSWEGO, N. Y.—The Water Department has adopted a resolution recommending condemnation proceedings on the property at the foot of Fifth Avenue, which is desired for the new power house for the water works system.

ROCHESTER, N. Y.—Plans are being considered for the installation of an electric lighting system on East Avenue to extend from the city line to the village line of Pittsford, a distance of about five miles. It is also proposed to light several of the lateral roads that connect East Avenue with the railways of the Rochester, Syracuse and Eastern and the Rochester and Eastern Rapid Railway companies. It is proposed to use the tungsten incandescent lamps.

TROY, N. Y.—Work has commenced on the construction of the power plant of the McCaffrey Water Motor & Power Company. It is proposed to develop 10,000 hp. J. G. McCaffrey, of Troy, N. Y., is president of the company.

CANDLER, N. C.—Steps have been taken to establish a rural telephone system in the western part of Buncombe County. O. B. Wright is interested in the enterprise.

VADE MECUM, N. C.—H. P. McKnight has purchased several water power properties, which he proposes to develop to furnish power to generate electricity. He also plans to build electric plants and transmission systems to furnish electrical energy to operate railways, lighting plants and industrial plants.

WINSTON-SALEM, N. C.—It is reported that H. P. McKnight, lessee of Vade Mecum Springs, located about 32 miles from Winston, contemplates the construction of an electric railway from Winston-Salem to the Springs. Later he proposes to continue the railway to Spray and Leaksville, provided the rights of way can be secured.

CANDO, N. D.—The capital stock of the Farmers' Telephone Company has been increased from $10,000 to $25,000.

STANLEY, N. D.—The Stanley Telephone Company, of which George W. Wilson is proprietor, has placed a contract with the Vote-Berger Company, of La Crosse, Wis., to install a complete telephone system.

AKRON, OHIO.—The Turkeyfoot Traction Company has been granted a franchise by the County Commissioners giving it permission to operate its railway on South Main Street from the city limits to Schwartz's Corners, where the proposed railway will leave the main road and continue to the lake district on private right of way. Thomas L. Childs is promoter of the railway.

FAIRVIEW, OKLA.—The city of Fairview is installing a municipal electric light plant in conjunction with the water works system. The equipment of the plant will include two direct connected Westinghouse 50-kw generators, two Weber gas engines with a rating of 80 hp each, with two 100-hp suction gas producers. Electricity will be transmitted to the pumping plant, five miles distant, to operate two 30-hp, 2300-volt motors. C. S. Nichols is superintendent of the water and light department.

ALBANY, ORE.—The City Council has granted a franchise to A. Welch to construct an electric street railway system on several streets of the city.

ALBANY, ORE.—Walter Mackay, of Portland, Ore., has filed a notice of appropriation of water rights on the Satiam River and Marion Lake. It is proposed to appropriate 12,000 cu. in. of water from Marion Lake and the Marion form of the Satiam River by means of a canal eight miles in length, which is to be known as the Lake Marion Power Canal, the water to be used for a hydro-electric plant.

GRANTS PASS, ORE.—The county court of Josephine County has granted the petition of the Rogue River & Oregon Southern Railway Company for a franchise to build and operate an electric railway from Grants Pass to Waldo, a distance of about 40 miles.

NEWPORT, ORE.—The City Council has granted to Hall Brothers a franchise to construct and operate an electric light plant and water works system in Newport.

PORTLAND, ORE.—The contract for the installation of a 600-hp hydro-electric plant for the Three Sisters Mining Company has been awarded to Edwin G. Amme, of Portland, Ore. The plant will be equipped with individual motors for all machinery.

PORTLAND, ORE.—Arrangements are being made by the Portland Railway, Light & Power Company for extensive improvements to its property, which will involve an expenditure of more than $1,000,000 the coming year. Plans are contemplated for a much larger expenditure next year. B. S. Josselyn is president.

PANAMA.—Bids will soon be received by the Isthmian Canal Commission, Washington, D. C., for furnishing a quantity of triple braided weatherproof solid copper wire as follows: 100,000 ft. No. 14 B. S. solid; 50,000 ft. No. 12; 50,000 ft. No. 10; 50,000 ft. No. 8; 50,000 ft. No. 6; 75,000 ft. No. 4; 150,000 ft. No. 2; also for the following quantities of rubber-covered wire, white core: 75,000 ft. No. 14; 50,000 ft. No. 12; 50,000 ft. No. 10; 30,000 ft. No. 8; 30,000 ft. No. 6; also 25,000 ft. ⅛-in. galvanized iron guy wire composed of seven No. 11 wires; 50,000 ft. No. 16 green double-conductor, twisted-braided, rubber-insulated, cotton-covered lamp cord; 20,000 ft. No. 13 two-conductor fixture wire; 20,000 ft. No. 16 damp-proof office wire; 15,000 ft. No. 14 duplex rubber-covered wire, solid conductor, and 15,000 ft. No. 12 duplex rubber-covered wire, solid conductor. Bids will also soon be asked for the purchase of two electrical air compressors for use at the Gatun locks. Captain F. C. Boggs is general purchasing officer.

ALTOONA, PA.—McDonough & Gavey, of New York, N. Y., are reported to be interested in a project to build an electric railway from Altoona to Bedford Springs by the way of Morrisons Cove, which will be about 50 miles in length. It is proposed to use the American Railways system from Altoona to El Dorado, and from there the new railway will pass through Duncansville, Roaring Springs, Woodbury and other towns to Bedford Springs. The cost of the railway, including power plants and rolling stock, is estimated at $1,500,000.

ELK LICK, PA.—The Pennsylvania & Maryland Street Railway Company has recorded a mortgage covering its property to the amount of $1,000,000 in favor of the Farmers' Loan & Trust Company, of New York, N. Y. The company is planning to build an extension of its system from Garrett to Johnstown, Pa.

ERIE, PA.—The Edison Electric Lighting Company has purchased a site at the corner of Eleventh and French Streets, on which it will erect a large addition to its power plant.

HARRISBURG, PA.—Governor Stuart has approved the application for the extension of the route of the Cumberland Railway Company, which was granted a charter recently to operate in Middlesex Township. The extension covers 13 miles in Carlisle and various townships in that vicinity. W. E. Glatfelter is president of the company.

KITTANNING, PA.—The Kittanning & Leechburg Railways Company contemplates increasing the output of its power plant by the installation of a 500-kw, 2300-volt, 60-cycle, alternating-current generator, direct connected. The company has placed an order for an additional 800-hp gas engine. T. A. Moesta is president of the company.

NISBET, PA.—The Nisbet Telephone Company has awarded a contract to the Erdman-Gessner Electric Company, of Williamsport, Pa., for the construction of its telephone line to run from Nisbet, through Bastress to Collomsville and Oval, a distance of seven miles.

PITTSBURG, PA.—The City Council has passed an ordinance authorizing the Mayor and Controller to advertise for bids for lighting the

streets and alleys with incandescent lamps. The ordinance fixes the term of the contract three years, instead of one, and the cost is not to exceed $112,000 per year.

RINGTOWN, PA.—Plans are being considered by the Ringtown Telephone Company to extend its system from Ringtown to Shermansville and Mainville, where connections will be made with Catawissa and Bloomsburg, connecting that territory with Shenandoah, Pa.

SCHUYLKILL HAVEN, PA.—The Pottsville Traction Company has submitted a proposition to the Borough Council to purchase the municipal electric light plant. The company proposes to take over the local plant and to furnish electricity in the borough for both lamps and motors.

MANILA, P. I.—The Manila Electric Railroad & Light Company has completed the installation of a new Wtstinghouse turbo-generator set and two Babcock & Wilcox boilers in its power house, increasing the output of the plant by 25 per cent.

CALHOUN FALLS, S. C.—The Calhoun Falls Cotton Mills are installing their initial equipment, including the installation of a 1000-hp steam plant. The mill will be arranged to be operated by either steam or electricity.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 21, for furnishing two electric freight elevators at the U. S. Navy Yard, Charleston, S. C., the cost of which is estimated at $8,500. William M. Smith is acting chief of bureau.

GREENVILLE, S. C.—It is reported that plans have been completed for the construction of the Greenville & Hendersonville Electric Railway. John P. Rowland is one of the directors of the company.

CHATTANOOGA, TENN.—D. J. Duncan has been granted a franchise for a trackless trolley line up Lookout Mountain and Walden's Ridge. A franchise has also been granted to S. W. Devine for a similar railway from Chattanooga to Coulterville, a distance of about 35 miles.

AMARILLO, TEX.—The Panhandle Telegraph & Telephone Company is making extensive improvements to its plant in this city, which will involve an expenditure of more than $20,000. H. H. Davenport is secretary of the company.

BRADY, TEX.—The local telephone company is making arrangements to change its system to the central energy system. The entire plant will be remodeled and new toll lines will be built.

FORT WORTH, TEX.—S. A. Tomilson, of Fort Worth, Tex., has been awarded a contract for the construction of the power house for the municipal electric light plant for $7,535. The equipment will include two engines and generator, the cost of which is estimated at $44,000. The plant will have sufficient output to supply electricity for 600 arc lamps in addition to the 200 lamps now in use. Lee Stephens is commissioner.

TEMPLE, TEX.—The Temple Light & Power Company is being organized. William Ginnuth, of Temple, is interested in the project.

TEMPLE, TEX.—Plans and specifications are being prepared by the W. D. Boyce Engineering Company, Chemical Building, St. Louis, Mo., for the construction of a power house in Temple, in connection with the proposed interurban electric railway from Temple to Waco and Marlin, Tex.

TYLER, TEX.—The Banner State Telephone Company, of Lima, Ohio, has been granted permission by the Secretary of State to operate a telephone system in Tyler. The company is capitalized at $60,000.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has awarded the contract, which includes the construction of a half-mile reinforced concrete pipe line 7 ft. in diameter, a 1000-ft. retaining wall and a dam across the river, in connection with the building of the new power plant to be erected in Weber canyon, to the J. P. O'Neil Construction Company, for $80,000.

MEARS, VA.—Plans are being made by A. F. Mears to establish a large canning factory next spring, which will include the installation of a generator, 120-hp boiler and two engines. The plant will furnish electricity to light the factory.

RICHMOND, VA.—Arrangements are being made to build an addition to the pumping station to be erected at the new reservoir, which will be used for the electric pumps. When completed the water will be pumped by electricity. The new pumps will have an output of 16,000,000 gal. daily.

CHATTAROY, WASH.—Arrangements are being made by the Farmers' Telephone Company for extending its telephone lines to connect Milan, West Branch and Chattaroy with Deer Park.

COLUMBIA CITY, WASH.—Arrangements are being made by the Seattle, Renton & Southern Railway Company for the construction of a power station at Columbia City, which will enable the company to increase its car service between Columbia City and Renton. The new plant will have an output of 600 hp.

DEER PARK, WASH.—The old light and water company of Deer Park has been reorganized and has applied to the City Council for a franchise to operate in the city.

MEDICAL LAKE, WASH.—The contract for the erection of the transmission line of the Big Bend Light & Power Company, from Spokane to Montfish, Mont., has been awarded to Edward Messinger, who will also have charge of wiring about 1000 houses on the route, where the company proposes to distribute electricity.

NORTH YAKIMA, WASH.—The Northwest Light & Water Company has applied to the County Commissioners for a franchise to erect transmission lines from the south end of Second Street through Toppenish and Sunnyside to the Benton County line. It is said that a similar franchise has been asked for in Benton County to Prosser. Robert S. Strahorn is president of the company.

PORT ORCHARD, WASH.—William Radley has announced his intention to apply for a franchise to construct and operate an electric light and power plant and water works system in Port Orchard. It is proposed to construct a dam on Blackjack Creek to furnish power to operate the electric plant, and to dig wells, the water from which will be pumped and distributed by electrical power.

SPOKANE, WASH.—The Washington Water Power Company has recently placed orders with the I. P. Morris Company, of Philadelphia, Pa., for the installation of four water wheels, each with a rating of 9000 hp with a head of 68 ft. The plant is to be located on the Spokane River, about 15 miles west of Spokane, and will furnish electricity for lamps and motors for towns in the vicinity of Spokane.

WALLA WALLA, WASH.—E. S. Isaacs, promoter of the Oregon-Washington Light & Power Company, has filed on water rights providing for 125 cu. in. per second on the Walla Walla River. The company proposes to build a power plant on the Walla Walla River about seven miles below the mouth of Skiphorton Creek to generate electricity which will be transmitted to Walla Walla, Wash., Pendleton, Ore., and other cities.

CUMBERLAND, WIS.—It is reported that the municipal electric light and water plant was badly damaged by an explosion recently, causing a loss of about $17,000.

GALESVILLE, WIS.—The Galesville Milling Company has filed amendments to its charter changing its name to the Davis Mill Company. The management of the company has not been changed. The company furnishes electricity for lighting the town of Galesville.

KENOSHA, WIS.—The Hanrahan & Linquist Company, 138 Washington Street, Chicago, Ill., which submitted a proposition to build and operate an electric light plant under a franchise from the city, or to build the plant and sell it to the city at a reasonable profit, have been asked to confer with the Common Council with a view of making an estimate on the cost of a municipal light plant.

MADISON, WIS.—Bids will be received by Lew F. Porter, secretary of the Wisconsin Capitol Commission, until Nov. 10, for the electric wiring of the east wing of the State Capitol, now under construction at Madison, Wis.

STEVENS POINT, WIS.—Arrangements are being made by the Wisconsin Graphite Company to erect transmission lines for the transmission of electricity from its McDill plant to this city.

NEW WESTMINSTER, B. C., CAN.—The British Columbia Electric Company is planning to build a large dam at Coquitlam Lake to furnish additional power for its plant. R. H. Sperling, of Vancouver, B. C., is general superintendent of the company.

ANCASTER, ONT., CAN.—The County Council has granted a franchise to F. Reinke and C. Shaver to erect a telephone line between Ancaster and Waterdown, a distance of about 21 miles. The cost of the system is estimated at about $10,000.

BELLEVILLE, ONT., CAN.—Application is being made for incorporation of a company to be known as the Belleville Radial Railroad Company to operate an electric railway in and around this city.

HAMILTON, ONT.—The contract for motors and pumps for the Beach Pumping Station was awarded by the fire and water committee to the Canadian Westinghouse Company, for $20,148. The contract for a system to pump water to the mountain top was awarded to John Montgomery Company, of Toronto, Ont., for $6,500.

OSHAWA, ONT., CAN.—The City Council is making application to Parliament for permission to construct and operate an electric light and power plant.

PORT ARTHUR, ONT., CAN.—The ratepayers carried the by-laws providing for an expenditure of $97,000 for power development and $32,000 for extensions to the electric lighting plant. A by-law was also carried providing for an expenditure of $25,000 for extensions to the civic telephone system. J. J. Carrick is Mayor.

PORT ARTHUR, ONT., CAN.—The city has entered into contract with the Kaministiquia Power Company, under which the latter is to furnish the city with 400 hp at the rate of $25 per horse-power per year. The company is to build a substation in Port Arthur, with an output of 3000 hp, to supply electricity in this city and at Fort William.

DUNDURN, SASK., CAN.—Plans are being made to organize a local telephone company to build a system in this town with rural lines to adjacent districts. For further information address E. J. Meilicke.

CHIHUAHUA, MEX.—Plans are being made by the Cia Productora de Hielo y Electricidad to build an electric light and power plant and ice plant in Sta. Rosalia. J. de Morambirt is president of the company.

New Industrial Companies.

THE AMERICAN ELECTRICAL MANUFACTURING COMPANY, of Orange, N. J., has been incorporated, with a capital stock of $350,000, by John C. Ireland, Everett Erithman and T. Wesley Wright.

THE NEW YORK MACHINERY EXCHANGE, of New York, N. Y., has been incorporated, with a capital stock of $10,000, by Jesse L. Law, Sr.; Jesse L. Law, Jr., and A. O. Law, all of Brooklyn, N. Y.

THE KELLEY ELECTRIC MACHINE COMPANY, of Buffalo, N. Y., has been chartered, with a capital stock of $25,000, by Guilford W. Francis, W. Morse Wilson and George L. Kelley, all of Buffalo, N. Y.

THE LOUIS HERNSHEIM, Inc., of New York, N. Y., has been chartered, with a capital stock of $5,000, by Peter H. Woods, Mount Vernon, N. Y.; Karl Gierth and Louis Hernsheim, of New York, N. Y.

THE WEBSTER FULL-EXPANSION ROTARY ENGINE COMPANY, of St. Joseph, Mo., has filed articles of incorporation with a capital stock of $100,000 by George Lamont, Eli Holland, J. J. Cain and others.

THE VESTA STORAGE BATTERY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $5,000 to manufacture electrical supplies. The incorporators are: David Perry, Henry O. Krausel and Jens Neilsen.

THE NEW YORK ENGINE COMPANY, of Portland, Me., has been chartered with a capital stock of $3,500,000 to manufacture and sell all kinds of engines. C. E. Eaton is president; T. L. Croteau, treasurer, both of Portland, Me.

THE ELECTRIC THERAPEUTIC DEVICES COMPANY, of Dover, Del., has filed articles of incorporation with a capital stock of $250,000. The incorporators are Alfred Williams, L. P. Goldstone, Max J. Voll, E. Hugh Pryor, all of New York, N. Y.

THE TRIPLE SIGN COMPANY, of Connersville, Ind., has been incorporated for the purpose of erecting and equipping a factory plant to manufacture electric advertising signs and novelties. Clinton M. Stone, J. W. Holter and C. L. Mathewson are the directors.

THE HAND WROUGHT METAL SHOPS, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Lela M. Rosenthal, W. Victor Toothaker and Adolph J. Rosenthal, all of New York, N. Y. The company proposes to manufacture gas and electric fixtures.

THE REPUBLIC ELECTRIC COMPANY, of Buffalo, N. Y., has been incorporated, with a capital stock of $5,000, to carry on a general electrical contracting business. The incorporators are: William E. Robertson, George B. Barrell, of Buffalo, N. Y., and V. C. Bruce, of Boston, Mass.

THE ANDREW H. HOAG COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $25,000, to manufacture gas and electric fixtures. The incorporators: Andrew H. Hoag, of Brooklyn, N. Y.; Charles Patzowsky, of New York, N. Y., and Philip De Berthron, of Hoboken, N. J.

THE HYGIENIC TELEPHONE MOUTHPIECE COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000, to manufacture hygienic shields for telephones. The incorporators are: Philip H. Collins, Mary E. Corson and Mary J. Collins, all of Brooklyn, N. Y.

THE ROCHESTER COIL COMPANY, of Rochester, N. Y., has filed articles of incorporation with the Secretary of State. The company is capitalized at $10,000 and proposes to manufacture electrical apparatus. The incorporators are: Thomas J. Murphy, Garrett Rekors and John W. Barrett, of Rochester, N. Y.

THE ELECTRO METALS COMPANY, of Bordentown, N. J., has been chartered with a capital stock of $30,000 by Harry H. Sturch, A. S. Dickison and N. W. Akimoff, of Bordentown, N. J. The company proposes to manufacture lead, iron, steel, glass, copper and other metals; also to do a contracting and building business.

New Incorporations.

STOCKTON, CAL.—The San Joaquin Valley Electric Railway Company has been chartered with a capital stock of $1,000,000 to construct an electric railway from Stockton to Modesto, a distance of 35 miles. The directors are: M. L. Brackett and H. E. Teter, of Stockton, Cal.; John G. Weir, E. T. Zook and J. E. Weaver, all of San Francisco, Cal.

ST. ANTHONY, IDAHO.—The Teton Light & Power Company has been chartered with a capital stock of $1,000,000 by G. E. Bowman and others.

BELLEVILLE, ILL.—The St. Louis & St. Liborg Railway Company has been incorporated to construct a railway from East St. Louis to St. Liborg, by Edward L. Thomas, John T. Taylor, David O. Thomas, C. A. Heinzelman and Gustave A. Becker, all of Belleville, Ill.

BETHELRIDGE, KY.—The Eubank & Bethelridge Telephone Company has been chartered by T. J. Acton; Silas Wesley, of Bethelridge, and Otis Housan, of Eubank.

DELHI, LA.—The West Carroll Telephone & Improvement Company has been organized, with a capital stock of $10,000, to construct and operate a telephone system throughout Richland Parish and other parts of the State. The company is a subsidiary of the Cumberland Telephone & Telegraph Company, and the officers are: W. B. Redmond, president; E. L. Bost, vice-president; W. W. Stevens, secretary and treasurer.

MINNEAPOLIS, MINN.—The Minneapolis & Ontario Power Company has been incorporated with a capital stock of $7,000,000 for the purpose of developing water power, establishing a paper manufacturing center and to conduct a lumber business. The company has placed contracts for the completion of a large dam and hyro-electric power stations at International Falls and Fort Francis. The directors are: Edward W. Backus and William F. Brooks, of Minneapolis, Minn.; Warren Curtis and John A. Davis, of New York, N. Y.; A. S. Peabody and Alexander Smith, of Chicago, Ill., and Warren Curtis, Jr., formerly of Cornith, N. Y.

McCOOK, NEB.—The McCook Electric Company has been incorporated with a capital stock of $100,000 by W. B. Berger, E. S. Berger and Irving Hale.

ROOSEVELT, N. Y.—The Roosevelt Water Power & Light Company has been incorporated with a capital stock of $40,000 by Edward Uhe, of Roosevelt, and Charles E. Whitehouse, of Hempstead, N. Y.

CLEVELAND, OHIO.—The East End Electric Company has been incorporated with a capital stock of $10,000 by C. R. Foster, A. E. Wolf, C. J. Foster, J. C. Hartman and J. W. Bogle.

MIDDLETOWN, OHIO.—The Middletown Lighting Company has been chartered with a capital stock of $150,000 by Barry S. Murphy, Ada McBride, C. W. Eliff, W. R. Sullivan and Dennis Dwyer.

CLEARFIELD, PA.—Articles of incorporation have been filed for the Dimeling Light & Power Company with a capital stock of $5,000. The directors are: H. S. Whiteman, Jr., treasurer; H. A. Kennedy, J. P. O'Laughlin, all of Clearfield.

WAYMART, PA.—The Kenn's Pond & Steene Telephone Company has been formed for the purpose of installing a telephone system.

WOMELSDORF, PA.—The Womelsdorf & Rehrersburg Rural Telephone Company has been organized with a capital stock of $5,000 and the following officers: A. M. Miller, of Stroudsburg, president; D. H. Bickel, of Rehrersburg, vice-president; D. H. Lego, of Rehrersburg, secretary, and M. S. Filbert, of Womelsdorf, treasurer.

MEMPHIS, TENN.—The Tennessee Electric Company has been chartered, with a capital stock of $5,000, by I. L. Canaway, J. H. Rudisell, T. S. Stinson and others.

AUSTIN, TEX.—The Austin County Telephone Company has been incorporated, with a capital stock of $6,000, by W. A. Natthaei, W. L. Guyler and E. V. Louwein.

HOLLAND, TEX.—Articles of incorporation have been filed for the Rural Telephone Company, of Holland, with a capital stock of $4,000, by J. P. Edwards, Henry Goodnight, H. H. Carlisle and others.

HOWE, TEX.—Articles of incorporation have been filed for the Howe Telephone Company, of Grayson County. The capital stock of the company is capitalized at $2,500 and the incorporators are C. A. Shock, S. D. Donohue and R. S. Daugherty.

CLIFTON FORGE, VA.—Articles of incorporation have been filed for the Jackson River Power Company, with a capital stock of $5,000. The company proposes to develop water properties and transmit electricity. The officers are: H. S. Jones, president; B. F. Donovan, secretary, and B. C. Goodwin, treasurer.

ROANOKE, VA.—The Craig Water Power Company has been incorporated, with a capital stock of $200,000. The company proposes to develop two water power properties, one on Meadow Creek and the other on John's Creek. The officers of the company are: A. L. Sibert, president; L. A. Scholz, vice-president; Henry Scholz, secretary and treasurer.

WINLOCK, WASH.—The O'Connell Electric Company has been incorporated, with a capital stock of $10,000, by M. T. O'Connell and Omar C. Spencer.

GREEN BAY, WIS.—The Bay Shore Railway Company has been chartered, with a capital stock of $15,000, by Fred A. Rahr, Frank E. Murphy and Arthur C. Neville.

MADISON, WIS.—Articles of incorporation have been filed with the Secretary of State for the Bruckerville Farmers' Telephone Company, of Holeton. The company is capitalized at $1,650, and the incorporators are J. A. Brownell, Joseph Lamer and Fred Mayer.

NESHKORO, WIS.—Articles of incorporation have been filed for the Neshkoro Light & Power Company, with a capital stock of $20,000, by E. D. Morse, Gustav Dahlke, Charles Dahlke and Edward Dahlke.

CANTERBURY, N. B., CAN.—The Canterbury & North Lake Telephone Company has been incorporated, with a capital of $3,000. The incorporators are: R. W. Copley, North Lake, N. B.; C. G. Folkins and N. H. Grant, of Canterbury, N. B.

YARMOUTH CENTRE, ONT., CAN.—The Yarmouth Rural Telephone Company has been incorporated, with a capital of $10,000. The incorporators are: D. Caughell, G. Summers and B. Griffin, all of Yarmouth Centre, Ont.

ATOTONILCO, MEX.—The Atotonilco Light & Power Company has been organized with a capital stock of $50,000 to install a hydro-electric plant to furnish electricity for lamps and motors in Atotonilco and surrounding territory. The company will utilize the water power of the Faretan waterfall, a short distance from this town. The cost of the plant is estimated at $30,000. The officers of the company are: Enrique Alvarez de Castillo, president; Francisco Munoz, vice-president; Alfredo Gonzales, secretary; Jose M. Corvera, treasurer, and Alfredo Gallardo, general manager.

Legal.

DECISION IN FAVOR OF THE NORTHERN POWER COMPANY.—The Public Service Commission, in an opinion prepared by Commissioner Decker, has announced its decision in the case of the Oswegatchie Light & Power Company, of Gouverneur, N. Y., against the Northern Power Company, in favor of the last named company. The case involved the question whether the Northern Power Company was an electrical corporation authorized to do business in Gouverneur under a franchise granted by the village in March, 1907, without applying for permission and approval of the Public Service Commission.

Personal.

MR. ALBERTO M. LABRIT, a graduate of Worcester Polytechnic Institute, has been appointed an electrical engineer in the Department of Public Works, Cuba.

MR. E. C. MORSE has been appointed in charge of the course in electricity recently established at the Franklin Union, Boston. Mr. Morse was graduated from the Worcester Polytechnic Institute in 1905.

MR. DAVID WILLIAMS, the veteran publisher of the *Iron Age*, has been elected president of the Federation of Trade Press Associations, which embraces the great bulk of the trade and technical publications of the country.

MR. H. P. HILL has sold his interests in the firm of Harvey & Hill and is opening an office at 50 Church Street, New York City. He will devote his time to consulting engineering work, particularly in connection with gas interests in association with gas engineers throughout the country.

MR. L. E. FISCHER, whose resignation as general manager of the Illinois Traction System will become effective in January, will manage the public utilities at Cairo, Ill., including the property of the Cairo Electric & Traction Company, and will develop an interurban railway system for Saline County, in Southern Illinois. Mr. Fischer contemplates later to offer his services as an independent expert in the utility properties.

MR. MATTHEW A. SAMMETT, hitherto associated with the Montreal Light, Heat & Power Company, as engineer in charge of tests and design, has severed that connection and has opened an office as consulting electrical engineer, etc., in the Canadian Express Building, Montreal. He was previously with the General Electric Company at Schenectady, and has followed closely the development of modern power house work and long-distance power transmission.

MR. HENRY C. MORRIS, for the last five years assistant general manager of the Bay City Traction & Electric Company, Bay City, Mich., has been appointed assistant to Mr. J. F. Collins, general manager and superintendent of the Saginaw-Bay City Railway & Light Company, controlling the railway and lighting properties in Bay City and Saginaw, Mich. Mr. A. J. Cunningham, who has been assistant general superintendent of the lighting properties of the Bay City Traction & Electric Company in Bay City, has been appointed to succeed Mr. Morris as assistant general manager of the Bay City Traction & Electric Company.

MR. PHILANDER BETTS, who for some years has been advisory engineer for the contract department of the Potomac Electric Power Company, has resigned his position and has opened offices in the Metropolitan Bank Building in Washington, D. C., for the general practice of consulting engineering. Mr. Betts was engaged in railway work in New Jersey and in Philadelphia in the pioneer days of electric railroading, and since that time has been in close touch with a variety of phases of the work, especially the problems involved in power economies. He completed recently a series of tests and investigations to ascertain the various losses of energy in the distribution system of the Washington Railway & Electric Company. The motor equipment of a new sand lime brick plant and the illumination of the new Masonic Temple in Washington are among his latest engagements.

NEUMULLER-FREDERICKS.—On Oct. 21 Mr. Walter Neumuller, of the contract department of the New York Edison Company, was married to Miss Frieda Fredericks, daughter of Mr. and Mrs. Hugo Fredericks, of New York City. The wedding took place at the Church of the Resurrection and was performed by the Rev. A. D. Pell. A wedding breakfast was served afterward at the Hotel Savoy, and then the happy pair departed on their honeymoon. Mr. Neumuller has been associated with Mr. Arthur Williams in the Edison service for many years and is highly popular with his associates as well as with a large circle of friends and acquaintances throughout the electric lighting field. He has done excellent work for the National Electric Light Association and for the recent Electrical Show at Madison Square Garden.

MR. GEORGE H. GUY.—We have received the following communication from Mr. George H. Guy:—"My attention has been called to the fact that my name has been unwarrantably used several times recently, as "Secretary of the New York Electrical Society," by way of giving apparently the endorsement of the Society to the subject matter. The latest instance of this kind is the circulation of a postal by the Phillips Publishing Company, in which the attention of the members of the Society is directed to an article in a November magazine, in the words: 'At the suggestion of Mr. Guy, Secretary of the New York Electrical Society, I wish to call your attention to an inspiring article, etc.' I wish to say that this is not only impertinent but absolutely unfounded. The Society's year book, with list of members is freely given to those desiring information concerning the Society. Application in this case was made for a copy, which was furnished, as usual, but without the slightest 'suggestion' from me of any kind whatsoever. It is rather hard that such official courtesy should be abused. I desire, therefore, to take this opportunity of saying that in no one instance where my name as secretary of the New York Electrical Society has been used in this manner, has there been the slightest warrant from any consent or permission on my part, and I wish to say, if it need be said, that no one has a keener sense than myself of the impropriety that would be involved in such action by me."

Obituary.

MR. J. E. SEARLES.—The death is announced in London, England, of Mr. John E. Searles, well known as the organizer of the "Sugar Trust," of which he was at one time secretary. During his financial career he was actively connected with the development of the Sprague Electric Company. He was 68 years of age.

DR. F. A. C. PERRINE.—Brief announcement was made in these columns last week of the death of Dr. Frederick A. C. Perrine, at his home, Plainfield, N. J., on Oct. 20, of Bright's disease, after a lingering illness of some months. While attending the annual meeting of the American Institute of Electrical Engineers at Atlantic City last June he became very seriously indisposed, much to the regret and alarm of his colleagues, and never regained ground. He was only forty-six years of age, and his career was full of achievement and promise as to the future. Dr. Perrine was born in Manalapan, N. J., and was educated in the Freehold Institute. He was graduated from Princeton in 1883, and took a post-graduate course until 1885. He received the degrees of A. M. and D. Sc. from this university. After holding the positions of manager of the insulated wire department of the John A. Roebling's Sons Company and treasurer of the Germania Electric Company, he became professor in electrical science and engineering at Leland Stanford University. In 1892 he married Miss Margaret Roebling, the daughter of Ferdinand W. Roebling, of Trenton, N. J. From 1898 to 1900 Dr. Perrine was chief engineer of the Standard Electric Company, of California, and in 1900 he was made president of the Stanley Electric Manufacturing Company, at Pittsfield, Mass. He retired in 1904 after its purchase by the General Electric Company, to become a consulting engineer, with offices in this city. He was editor of the *Journal of Electricity*, in San Francisco, from 1894 to 1896, and also of *Electrical Engineering*, in Chicago, from 1896 to 1898. He wrote "Conductors for Distribution," based upon a valuable series of articles contributed originally to the *Electrical Engineer*. Dr. Perrine was a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Lawyers and Engineers' Club, of New York, and the American Society of Civil Engineers, and the Institution of Electrical Engineers of England. He left a widow, two daughters and a son. Dr. Perrine served as chairman of the Code Committee of the Institute, and at all times took a deep interest in its affairs, being considered several times for the presidency. In 1900 he was awarded a gold medal at the Paris Exposition in recognition of his work on the first great transmission line, built for the Standard system in California. He was a man of high character and genial disposition, and enjoyed the esteem and admiration of a host of friends on both sides of the Atlantic. The interment took place on October 22 at Old Tennent Church, near Freehold, N. J.

F. A. C. PERRINE.

Educational.

ARMOUR INSTITUTE.—During the coming year there will be published Volume I of the *Armour Engineer*, the semi-annual technical publication of the student body of Armour Institute of Technology. This is an engineering magazine issuing two large numbers each year, one each semester. It contains technical articles by prominent Armour graduates, results of research in the Armour testing laboratories, best papers presented to the engineering societies, editorials, book reviews and engineering notes and comments.

Trade Publications.

ELECTRICAL SUPPLIES.—The latest calendar card of the F. Bissell Company, Toledo, Ohio, draws attention to the promptness with which electrical supplies and machinery can be obtained from it.

PAISTE SWITCHES.—Bulletin No. 59 of the H. T. Paiste Company, of Philadelphia, illustrates and describes Fielding receptacles, and shows

their application to various classes of work. New designs in panel cut-outs for rotary snap switches are also shown.

TUNGSTEN MINIATURE LAMPS.—The Central Electric Company, Chicago, Ill., has issued new price-lists on Columbia low-voltage tungsten miniature lamps for battery service. The introduction of these miniature lamps is of interest to those having occasion to use battery lamps.

FLAMING ARC LAMPS.—The Excello Arc Lamp Company, 30 East Twentieth Street, New York, has issued a well-prepared bulletin giving much valuable engineering information concerning the characteristics of flaming arc lamps. Price lists are given of complete arc lamps and also of electrodes and other accessories.

ALLAN METAL.—A sumptuously executed catalog issued by A. Allan & Son, New York, sets forth the advantages of Allan metal for anti-friction purposes. Excellent illustrations and well-written instructions make clear the manner of application of the material to various designs of steam-engine pistons and to stuffing boxes.

CUTHBERT SWITCHBOARD APPARATUS.—The Cuthbert Electrical Manufacturing Company, Chicago, has issued in flexible cloth covers a new edition of its catalog of switchboard apparatus and fittings, comprising 128 pages. A feature of the new edition is a folding illustrated index attached to the back cover, printed on paper backed by linen.

FEEDER REGULATOR.—The General Electric Company, Schenectady, N. Y., in Circular No. 3702, describes its single-phase feeder regulator and the benefits to be derived from the use of such apparatus in connection with alternating-current lighting systems. This regulator is designed for operation on 220-volt, 60-cycle circuits, and may be used with either hand or sprocket control.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing circulars describing "Galvaduct" interior conduit, calling attention to the various structural details. Complete data is also given on the diameter, threads per inch, weights and prices. By means of a chart a graphic representation is given of the comparative sizes of double-braided wires and Galvaduct conduit. Copies of this circular will be mailed upon request.

PRICE BOOK OF ELECTRICAL MATERIALS.—The B. & C. Electrical Construction Company, Utica, N. Y., has provided for its customers a handsome loose-leaf binder for its price-list sheets. The volume is handsomely bound in morocco, with calf inside cover lining, provided with a thumb index, and interleaved with blank pages. All pages have two blank columns, one for the insertion of the cost, and the other of the selling price of materials listed.

IGNITION SPECIALTIES.—The Pettingell-Andrews Company, Boston, Mass., has just issued a neat and handsome catalogue of its ignition specialties for the present season. It includes a great variety of styles and sizes in spark coils, switches, indicators, batteries, wires, etc., intended for automobiles and motor boat purposes. A number of excellent trade mark and standard goods are included, and practically all the apparatus is illustrated. In many instances the descriptions are quite full. The company is exclusive selling agent in this line for the Jacobson-Brandow Company, of Pittsfield, Mass.

THE LOMBARD GOVERNOR COMPANY, of Ashland, Mass., has just issued Bulletin No. 110, which in some ways is the most interesting trade publication on water-wheel governors which has yet appeared. Not only does it describe and illustrate eleven types of water-wheel governors which are largely in commercial use at the present time, but it also gives a list of about 500 typical water-wheel units grouped according to the type of governor used. No similar classification of water wheels has before been published, so far as we know. The descriptive text in this bulletin is extremely clear and explicit, and the numerous illustrations are of a high order. The pamphlet is a small quarto of 50 pages.

ROTARY CONVERTERS.—Allis-Chalmers Company, Milwaukee, has issued Bulletin No. 1045 devoted to its rotary converters, for which it has enjoyed a large demand. This apparatus has many features of importance to the engineer. Special attention has been given to the proper ventilation of the armature, the ventilating spacers being so designed as to force circulation of air through the armature. This results in low temperature and enables the machine to stand heavy overloads without injury. The iron loss and heating of the poles has been reduced to a minimum by a special arrangement described in the bulletin mentioned. Another point is found in the construction of the armature. This is built up of thin disks punched from very soft and specially prepared steel, of uniform quality, and high permeability. After punching, these disks are thoroughly japanned to prevent eddy currents.

FRINK TUNGSTEN REFLECTORS.—A new illustrated catalog, No. 56, on tungsten reflectors, etc., has just been issued by I. P. Frink, 551 Pearl Street, New York City. This famous concern, whose history runs back into the dark ages when there was neither gas nor electricity, has always shown an extraordinary degree of intuition in perceiving the tendency of illumination practice and in keeping not only abreast of the practical art, but at its head. This catalog is an interesting proof of commercial alertness, for its contents deal with the new tungsten lamps and show a grasp of the situation. The special reflectors embody all the essential conditions that are necessary in dealing with the new illuminant, and offer many practical ideas that will be promptly welcomed by central-station managers all over the country. We have seen no catalog more timely and useful than this.

POLYPHASE MAXIMUM WATT DEMAND INDICATORS.—Commercial maximum demand indicators have heretofore been confined to devices which would indicate the maximum ampere demand only, and were not suitable for recording the maximum load on alternating current circuits of other than unity power factor and constant voltage. In Bulletin No. 4622, just issued by the General Electric Company, Schenectady, N. Y., the company illustrates and describes its polyphase maximum watt demand indicator suitable for recording the maximum load on alternating current circuits, irrespective of power factor and voltage fluctuations. These indicators are made self-containing in capacities of 125 to 150 amp, 220 to 650 volts. With instruments of greater capacity, current and potential transformers are used. Full descriptions, with connection diagrams and dimensions, are given in the bulletin.

SEWING MACHINE MOTORS.—The General Electric Company, Schenectady, N. Y., describes in a bulletin recently issued on this subject its new line of sewing machine motors. These motors are adapted to domestic use, dressmaking and tailoring and for light manufacturing purposes. Those intended for domestic use are provided with a jaw clamp foot, enabling the motor to be readily attached to the sewing machine table, and are arranged for use with all standard makes of machines, of both the stationary head and drop head types. Motors for dressmaking and tailoring and for light manufacturing purposes are of slightly greater capacity and are furnished with either clamp foot or flat foot frame. The motors are made for use on 115 and 230 volt, direct-current circuits, and 110 and and 220 volt, 60-cycle, alternating-current circuits. Bulletin No. 4611 gives a detailed description of these motors, and contains dimension diagrams, weights and other data in connection with them.

TRANSFORMER STEEL.—The Pittsburg Transformer Company, Pittsburg, Pa., has published an interesting 20-page booklet entitled "Silico-Vanadium Steel." The cover of this publication is unique, due to the fact that it is an exact photographic reproduction of a sheet of silico-vanadium steel. The booklet is very comprehensive, inasmuch as it describes the manufacture of steel, beginning at the opening of the ore beds in Minnesota and continuing through the processes of loading and unloading the enormous ore-carrying lake steamers, charging and operating the blast furnaces, making and stripping the ingots, as well as rolling these into sheets. The booklet is illustrated with 23 engravings and is therefore one of the most complete trade publications in sheet steel. In the latter part of the booklet, the company calls attention to the great improvement in Pittsburg Transformers, which it states is due to the use of silico-valadium steel.

"STEAM; ITS PROFITABLE UTILIZATION" is the title of a 12-page illustrated pamphlet which the Harrison Safety Boiler Works, 3159 N. Seventeenth Street, Philadelphia, Pa., have reprinted from *The Bookkeeper and Businessman's Magazine*. This paper discusses the steam requirements of prime movers, such as pumps, reciprocating engines, steam turbines, etc., under different conditions, as when exhausting freely to the atmosphere, running condensing, etc., and shows how much of the heat contained in the steam is utilized to produce power, and how much is available for such purposes as heating buildings, drying materials, providing hot water for boiler feeding and industrial purposes, etc. It then proceeds to explain different arrangements for utilizing exhaust steam in the ways just mentioned. An important conclusion reached is that it is poor economy to install expensive engines, condensers, etc., to secure low steam consumption as long as a use can be found for the larger quantity of exhaust steam from less costly engines.

GENERAL ELECTRICAL SUPPLY CATALOG.—The Central Electric Company, Chicago, is distributing its 1909 general catalog, which is a handsome volume of 1024 pages. It has been the company's aim to make this catalog the most complete ever issued. Considerable space is given to the specialties for which the company acts as sales-agents, namely, Columbia incandescent lamps, Pittsburgh transformers, Okonite wires and cables, G-I arc lamps, and New Lexington high tension insulators. One is naturally interested also in the extensive line of fixtures which are shown and which naturally give some conception of the fixture department, the most extensive in the West. The special announcement printed on the last page of the catalog is also interesting as outlining in a general way some of the company's plans for expansion. The company is desirous of placing a copy of this catalog in the hands of every individual who is actively engaged in plant operations, or who has anything to do with the specifying or purchasing of electrical material. Individuals who have not received a copy of this catalog are urged to write for one.

Business Notes.

FREIGHT TRAVELERS.—The Cleveland Crane & Car Company, of Wickliffe, Ohio, which has not made cars for some years past, has changed its name to that of the Cleveland Crane & Engineering Company. Under this title its productions will be confined exclusively to cranes of every kind, including traveling, gantrys, mono-rail and grab-bucket handling equipment of various types. The New York office is at 91 Liberty Street, and the Chicago office, 1203 Marquette Building. E. I. Leighton is president; W. D. Sayle, secretary, and C. C. Robbins, treasurer.

THE SPRAGUE ELECTRIC COMPANY has found it necessary in order to handle the increasing demand for its products in the Southern territory to open a branch office in Atlanta, Ga., in addition to the New Orleans office. Both of these offices are under the management of Mr.

F. V. L. Smith, who is well known in the South, and who has been in charge of the Sprague Company's office in New Orleans since its establishment. The Atlanta office is located in the Empire Building.

NEW CONTRACTING FIRM.—Mr. I. Levinson has recently severed his connection with the construction department of the United Cigar Stores Company, where he has been engaged for seven years as electric light engineer and superintendent of electrical construction, to organize the Eastern Electrical Equipment Company, of 43 West Twenty-seventh Street, New York City. This concern will do a regular contracting business in light and power equipments, building new ones or renovating old.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 20, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

901,322. ELECTRICAL ACCUMULATOR; Charles Busch, New York, N. Y. App. filed July 15, 1908. A storage battery plate designed to be as durable, economical and efficient as possible. The active material is received in a hollow lead sheathing, the walls of which are woven or tied together like a mattress.

901,331. ELECTRIC RAILWAY SIGNAL; Edward A. Everett, Detroit, Mich. App. filed June 27, 1906. A means for use in connection with relays employed in the operation of automatic block signals for effecting an auxiliary release or circuit-breaking device, whereby the signal circuit will be automatically broken, even if the contacts are fused at the usual circuit-breaking lever.

901,332. INSULATING MATERIAL; Willis Eugene Everette, Tacoma, Wash. App. filed May 17, 1906. A pure mineral wool compound, composed solely of calcium, aluminum, silicon and oxygen.

901,336. AUTOMATIC ELECTRIC LIGHTING SYSTEM; Carl J. Gardeen, Columbus Township, Minn. App. filed Dec. 5, 1907. An electric lighting plant having an engine, dynamo and storage battery, and means whereby when the last lamp is put out the engine will be automatically stopped.

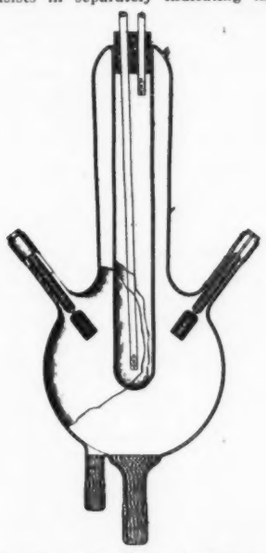
901,341. ALTERNATING-ELECTRIC-CURRENT MACHINERY; Alexander Heyland, Brussels, Belgium. App. filed May 2, 1903. A means for compounding alternating-current machines.

901,349. BURGLAR ALARM; Patrick T. Keefe, New York, N. Y. App. filed Jan. 8, 1908. A burglar alarm designed to be inset in the door sash and having a push-button which is depressed when the door is fully closed.

901,352. WATER PURIFIER; Henry Korten, Chicago, Ill. App. filed May 23, 1907. Has an outer casing including a series of electroplates, and a perforated metallic basket containing interlocking disks at the bottom of said series of electroplates.

901,368. APPARATUS FOR MAGNETIC SEPARATION; Clarence Q. Payne, Stamford, Conn. App. filed Oct. 3, 1903. Magnetic ore separator for the concentration of substances of all degrees of magnetic permeability. Has a toothed rotary member between the poles of the field magnet and across the surface of which the ore is led.

901,372. TELEGRAPHY; Louis M. Potts, Baltimore, Md. App. filed March 9, 1907. The method of balancing a plurality of electric circuits, which consists in separately indicating the relative effects of



901,427—Vapor Electric Apparatus.

the different constants of the circuits, and changing the values of said constants until a balance of each is indicated.

901,377. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed April 18, 1905. This patent and the series which immediately follows relate to a single subject-matter of invention, and include all of the electrical and mechanical features of a complete signal system for alternating-current railway installations. The claims relate to more or less detail features throughout this series of patents.

901,378. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed April 9, 1906.

901,379. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed Aug. 13, 1907.

901,380. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed March 13, 1905.

901,381. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn. App. filed Jan. 26, 1905.

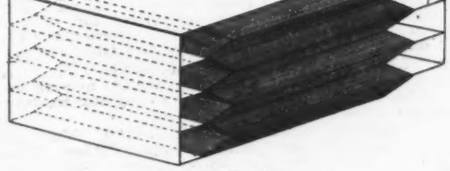
901,382. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed Oct. 27, 1902.

901,383. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed July 20, 1904.

901,399. ELECTROPLATING APPARATUS; Abraham Van Winkle and John T. Daniels, Newark, N. J. App. filed June 7, 1907. An apparatus for the electro-deposition of metals upon wire in the coil, or upon chains, hoops or similar articles which can be arranged upon a revolving support arranged in an electric circuit, and about which the coil of wire, chain hoop, or the like, is placed so as to receive a rotary motion.

901,422. CONNECTOR FOR ELECTRICAL CONDUCTORS; Frank B. Coo, Chicago, Ill. App. filed April 2, 1908. A double-coned, split bushing is clamped upon the ends of the aligned conductors by threaded sleeves received upon the coned portions.

901,423. SWITCH FOR CHARGING AND DISCHARGING STORAGE BATTERIES; James H. Cormick, Belleville, N. J. A switch for charging and discharging storage batteries. Has two storage



901,498—Condenser.

batteries, a charging line and a discharging line, and a switch so operated that the discharging line will always be in circuit with at least one of the storage batteries, and the circuit of the charging line never broken, even though it is not in circuit with either of the storage batteries.

901,424. ELECTRICALLY CONTROLLED SWITCH; Archibald S. Cubitt, Schenectady, N. Y. App. filed April 22, 1908. Has electrically controlled switches in which a current carrying coil is employed for maintaining the switch in one of its positions. Is particularly adapted for use in connection with relays in which a movable cord is by some means moved to a certain position and is held thereat by the magnetizing effect of a holding coil.

901,427. VAPOR ELECTRIC APPARATUS; Leonard E. Dempster, Schenectady, N. Y. App. filed Oct. 31, 1904. The conductor has a protective and radiating sleeve therefor, consisting of vitrious material with metal embedded therein.

901,432. ARC-LAMP HEADLIGHT; Richard Fleming, Lynn, Mass. App. filed June 16, 1905. Has mechanical features for a locomotive headlight by which the arc is maintained properly fixed in front of the reflector.

901,435. AMUSEMENT DEVICE; Percy W. Fuller, Boston, Mass. App. filed July 8, 1907. A hollow drum has armature coils embedded in its periphery and which co-operates with field coils in an inclined track so that the drum will roll up the incline.

901,440. DYNAMO-ELECTRIC MACHINE; Arthur L. Hadley, Fort Wayne, Ind. App. filed May 14, 1906. Has a field pole composed of a central section of laminae interposed between two side sections of laminae, the laminae forming the central section being wider than the laminae in the side sections.

901,441. SELECTIVE SIGNALING SYSTEM; Orlando W. Hart, Fall River, Mass. App. filed Aug. 10, 1907. Means whereby an operator at a central station can cause a signal at any one of two or more other places, to be set and automatically locked in operative position until the person sending back a signal to the central station restores it to normal position.

901,445. PRIMARY BATTERY; Karl Heintz, Munich, Germany. App. filed Dec. 26, 1907. A Bunsen cell containing a mixture of sulphuric acid and 30 per cent nitric acid and which is separated from the exciting solution by means of a carbon diaphragm.

901,448. FUSE HOLDER; Bryson D. Horton, Detroit, Mich. App. filed Aug. 29, 1904. The fuse element is embedded in a casing and the cartridge fuse at its reduced portion is embraced by a thread connected to a spring plate on the exterior of the casing.

901,477. ELECTRIC RAILWAY SYSTEM; William Robinson, Brooklyn, N. Y. App. filed Oct. 5, 1904. Electric railway system in which the third rail is divided into insulated sections normally disconnected from the source of working current.

901,479. ELECTRIC PROTECTIVE APPARATUS; Charles A. Rolfe, Adrian, Mich. App. filed April 20, 1903. The thermal cutout includes a non-conducting softening material comprising wax, rosin and a powdered conductor.

901,497. CARBON ELECTRODE; Joseph T. Szek, London, Eng. App. filed Sept. 23, 1907. A carbon electrode having longitudinal grooves throughout its length, a passage through said electrode and a transverse groove at the base of said electrode, said passage and said transverse groove communicating with a plurality of the said longitudinal grooves.

901,498. CONDENSER; Elihu Thomson, Swampscott, Mass. App. filed May 5, 1904. A condenser includes a pair of active conductors of opposite polarities, and one or more stress-equalizing conductors between said active conductors and insulated therefrom.

901,506. VAPOR-ELECTRIC APPARATUS; Willis R. Whitney, Schenectady, N. Y. App. filed Oct. 31, 1904. Has a glass tube containing mercury and constituting one electrode, and a metal tube sealed

about said glass tube in proximity to said mercury and having an exposed portion constituting another electrode.

901,509. SWITCH FOR CHARGING AND DISCHARGING STORAGE BATTERIES; Asbury G. Wilson, Wilkinsburg, Pa. App. filed Feb. 28, 1908. A switch for charging and discharging storage batteries and including double sets of blades clipped together so as to move in unison.

901,512. RHEOSTAT; Paul H. Zimmer, Schenectady, N. Y. App. filed May 20, 1907. Has a rheostat for starting resistance, and the speed then controlled through another resistance, preferably in the motor field circuit, the arrangement being such that the field strength cannot be varied until running conditions have been established in the armature circuit.

901,513. INDUCTION-MOTOR CONTROL; Ernest F. W. Alexanderson, Schenectady, N. Y. App. filed July 12, 1906. In combination with a single-phase source, two polyphase induction motors of different pole-numbers, a load to be driven, a switch adapted to connect the primary windings of both motors in parallel, with one phase connected to the source, and a magnetic clutch for each motor adapted to connect it mechanically with the load.

901,514. SYSTEM OF MOTOR CONTROL; Hans Alexander, Berlin, Germany. App. filed May 20, 1907. Relates to motor control systems for electrically driven rolling mill motors which are subject to heavy overloads and must be frequently reversed. Designed to avoid the use of the usually heavy switch which has been necessary in securing the reversal.

901,529. ARC LAMP; Richard Fleming and Cromwell A. B. Halvorson, Jr., Lynn, Mass. App. filed May 16, 1904. Has a pair of electrodes brought together to strike an arc, and means for thereafter rapidly rocking one of said electrodes and for slowly moving the other of said electrodes away from the rocking electrode.

901,540. COMBINED ELECTRIC ALARM AND LIGHT; William A. Lindsey, Narberth, Pa. App. filed July 18, 1907. Circuits by which a lamp and bell are simultaneously operated in a burglar-alarm system.

901,570. TELEPHONIC TRANSMITTER; Frederick G. Warrell, Lansdowne, Pa. App. filed Oct. 3, 1907. In a telephonic transmitter, a diaphragm, a casing, oppositely disposed poles therein, a filling of loose material in the said casing, means for insulating one of said poles and said loose material from said casing, said other pole being secured to said diaphragm, and insulation covering the rear surface of said diaphragm and the periphery of said latter pole.

901,593. OUTLET BOX; Harry A. Coffin, Malden, Mass. App. filed Jan. 12, 1907. A form of outlet box adapted to serve in place of several different types now in use. Is a composite structure and can be assembled in different ways.

901,613. ELECTROMECHANICAL REGULATOR FOR ELECTRIC TENSION; Joseph Michel Camille Herrgott, Valdote, France. App. filed April 27, 1906. The valve rod of a steam engine is actuated by an electromagnet in place of the usual valve gear to secure certain regulation features.

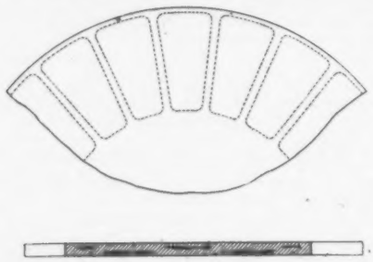
901,614. CIRCUIT-BREAKER; Edward M. Hewlett and Theodore E. Button, Schenectady, N. Y. App. filed Oct. 22, 1904. A circuit-breaker of the type in which one or more sets of shunt contacts are provided and in which the final break is made between carbon contacts. Includes detail features of the tripping mechanism, etc.

901,627. INSULATOR; Royal T. Langlan, Boston, Mass. App. filed Dec. 10, 1907. An insulator which may be interposed between the frame of the box or rheostat and its supporting beam, so constructed as to completely insulate the frame from the beam, and prevent the leakage of water from the frame to the supporting beam, or the formation of a film of water between them which would serve as a conductor for the electrical current.

901,630. OPERATING MEANS FOR CIRCUIT-CONTROLLING DEVICES; Julius K. Luk, Washington, D. C. App. filed July 31, 1906. An operating means for an electric switch, comprising a spring-pressed connection for normally driving the said switch and for releasing the said driving connection when power in excess of a predetermined amount is applied to the said operating means.

901,649. SPACE TELEGRAPHY; Oscar C. Roos, Newton, Mass. App. filed June 10, 1907. A duplex space telegraph system in which the transmitting and receiving apparatus are permanently connected with the antenna or elevated conductor and are constructed and arranged to be operated simultaneously without mutual interference.

901,666. DISK FOR INFLUENCE OR STATIC INDUCTION AND CONDENSER MACHINES; Alfred Wehrsen, Berlin, Germany. App.



901,666—Disk for Influence or Static Induction and Condenser Machines.

filed March 10, 1908. A static induction machine having a disk composed of insulating material and having metal sectors embedded therein.

901,668. SAFETY APPARATUS FOR RAILWAYS; Samuel L. Adelson, New York, N. Y. App. filed March 18, 1908. A safety device for railways, comprising a track apparatus arranged in blocks and a car provided with an alarm, the car having a movable arm for actuating said alarm when moved and means for holding the alarm circuit open.

901,669. MULTIPARTY LINE TELEPHONE EXCHANGE SYSTEM; Garrison Babcock, Rochester, N. Y. App. filed Aug. 4, 1904. Selective signal circuits for party line system.

901,672. MULTIPLE SWITCHBOARD JACK; Jules A. Birsfield, Rochester, N. Y. App. filed Feb. 13, 1905. Details of switchblade mechanism.

901,683. SUPERVISORY SYSTEM; Merritt S. Conner, Chicago, Ill. App. filed March 5, 1904. Supervisory signal circuits for central exchange. This patent and the following series relate to various features of central exchange circuits of telephone systems.

901,696. TELEPHONE EXCHANGE SYSTEM; William M. Davis, Chicago, Ill. App. filed April 26, 1901. Detail features of signaling circuits.

901,698. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; Bert G. Durham, Chicago, Ill. App. filed Oct. 5, 1904. In an automatic telephone system, a subscriber's line, a metallic circuit trunk line, a selector serving to connect said subscriber's line with said trunk line, controlling magnets for said selector, switches operated by said controlling magnets to open the circuit of said magnets upon the completion of a selection, and electromagnet mechanism controlled over the line circuit to actuate said selector to disconnect said subscriber's line from said trunk line.

901,704. RECEIVER; John S. Goldberg, Chicago, Ill. App. filed Nov. 23, 1903. In a receiver, the combination of an outer cylindrical casing consisting of a continuous one-piece shell of magnetic material of which diametrically opposite regions are oppositely polarized, bent pole pieces extending from such polarized regions, coils disposed on such pole pieces and held in place between the bent ends and the upset ends thereof, and a diaphragm disposed over the pole faces of said pole pieces.

901,706. CABLE SUPPORT; Elbert A. Hawkins, Baldwin, N. Y. App. filed Dec. 18, 1906. A swinging bracket consisting in a supporting block, a bent bar adapted to extend vertically through such block and horizontally below such block, the vertical portion of such bar conformed to rotate in such block, means for supporting such bar from such block, means for preventing rotation of such bar in such block, and means for releasing such bar from such block to permit rotation of such bar, and means for normally preventing the removal of the bar from the block.

901,738. SUBSCRIBER'S TELEPHONE CIRCUIT; Howard M. Post, Chicago, Ill. App. filed July 31, 1905. A subscriber's telephone circuit comprising two paths for current, one of said paths containing a receiver and a condenser in series, the other of said paths containing the coils of a ringer, a transmitter in series with both paths, and means for placing said condenser and ringer in series in the telephone line.

901,765. MAGNETIC SEPARATOR; Reuben J. Wright and Homer E. Frost, Cleveland, Ohio. App. filed May 10, 1907. In a magnetic separator, a chute, a cutoff valve therefor, and electromagnet over the chute, a switch in the circuit of the magnet, and mechanically connected to the valve-operating mechanism, and switch contacts arranged for closing the switch prior to the opening of the valve.

901,785. TELEPHONE SYSTEM; Elmer R. Corwin, Chicago, Ill. App. filed Dec. 26, 1906. A telephone exchange system, including telephone lines, jacks therefor, a cord circuit for uniting telephone lines in conversation, an operator's telephone equipment, and two relays, each serving to establish connection of the operator's equipment with the cord circuit, and each adapted to break the connection it effects, one of said relays being controlled by the plug used as an answering plug and apparatus associated with the line connected with the said answering plug, while the other relay is controlled by the plug used as a connecting plug and apparatus associated with the line connected with the said connecting plug.

907,795. TRIPOD FOR SUPPORTING LIGHTING FIXTURES; Edwin A. Emery, Galva, Ill. App. filed Aug. 26, 1907. A tripod for the purpose specified comprising an upper and a lower plate, said upper plate having a plurality of curved converging arms, the lower plate having a like number of similarly curved diverging arms, the arms of the lower plate being arranged above and supported upon the arms of the upper plate, and means to adjustably secure the corresponding arms of said plate together.

901,809. SURFACE CONDENSER; Anthony Harris, Greenock, Scotland, and Frederic A. Anderson, Westminster, Eng. App. filed April 25, 1905. A means to overcome the corrosion of copper or Muntz metal surfaces or tubes due to the impurities contained in the circulating water. Has a body of aluminum arranged to be immersed in the water.

901,816. TROLLEY WIRE ANCHOR; Allan McIsaac, Hartford, Conn. App. filed March 4, 1908. An anchor for a trolley wire whereby the latter is securely supported on cross wires, arms or the like.

901,850. TELEPHONE RECEIVER HOLDER; George J. Thomas, New York, N. Y. App. filed Aug. 14, 1907. A telephone receiver holder, comprising a bracket provided at its upper end with a bifurcated portion, an arm pivotally mounted upon the bifurcated portion of said bracket, a plunger, means supporting said plunger upon said bracket, a spur carried by said arm within the bifurcated portion of said bracket, said spur adapted to engage said plunger, and telephone receiver supporting means formed upon said arm.

901,861. TELEGRAPHIC SOUNDER; Vincent C. De Ybarrondo, Los Angeles, Cal. App. filed May 6, 1907. A sounder for telegraphic systems having means adapted to be substituted for the gong of an electric bell, whereby the hammer can be used for giving the sounds.

901,869. PROTECTOR FOR TELEPHONE TRANSMITTERS; Josef Baumgarten, New York, N. Y. App. filed Jan. 18, 1908. A protector for telephone transmitters comprising a cylindrical body portion, a collapsible funnel of flexible material mounted therein and adapted to fit a telephone transmitter, a diaphragm closing one end of the funnel, and a retaining means for holding the funnel collapsed and protecting the diaphragm when not in use.

901,871. ELECTRIC HEATER AND DRIER; George N. Blanchard, San Francisco, Cal. App. filed Feb. 21, 1908. Has an air-forcing fan, a discharge tube, and a pyramidal electrical resistance coil fixed within said tube.

901,878. TROLLEY WHEEL BEARING; William M. Caswell and Joseph A. Schofield, Warren, Pa. App. filed Dec. 16, 1907. A spindle on which the trolley wheel operates to circulate the oil and which is threaded into blocks which are clamped within the split portions of the trolley harp and journal boxes.

901,885. ELECTRIC CONTACT SPRING FOR TROLLEY HARPS; Albert L. Cole, Auburndale, Mass. App. filed Sept. 28, 1905. Spiral springs are contained between the trolley wheel of the harp so as to establish good connection between the parts.

901,894. INDICATOR FOR TELEPHONE CALLS; Eugene T. Ducharme, Boston, Mass. App. filed Nov. 15, 1907. In a telephone box, a bell, a clapper for ringing the same, a pivotally mounted arm, an indicator disk carried by said arm, combined with means for causing the first movement of said clapper to be communicated to said arm.

901,899. ELECTRIC SIGNALING SYSTEM FOR RAILWAYS; William J. Higgins and Christopher J. Sheridan, Buffalo, N. Y. App. filed Dec. 27, 1907. Overlap railway signal system having a mechanism whereby semaphore arms may be set for danger or distance signals and whereby cab signals in a locomotive are simultaneously actuated.